

Extensible Rectangular Nozzle Test Models Draft Statement of Work

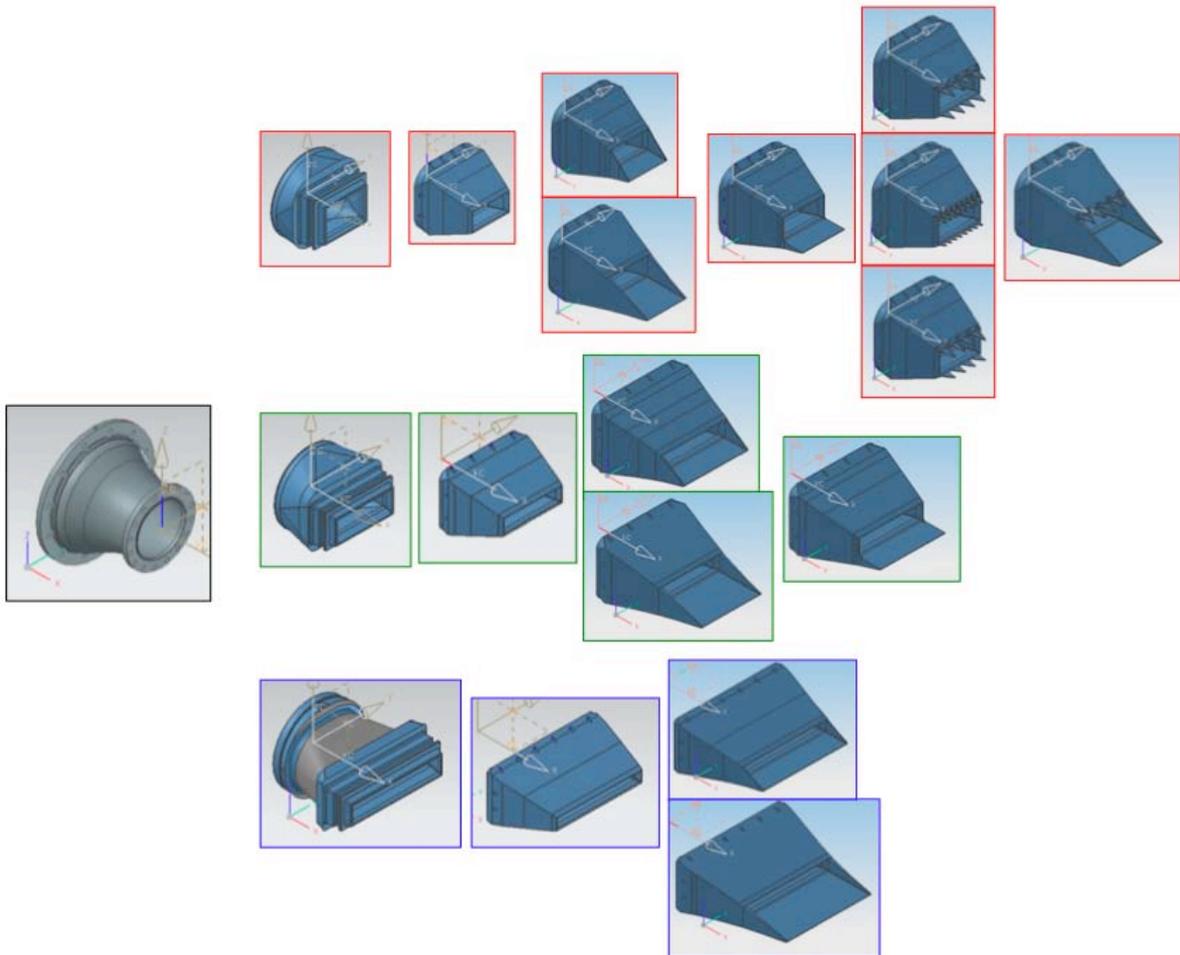




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1. INTRODUCTION

This Statement of Work describes the fabrication of the Rectangular Nozzle Model System. The items to be fabricated are identified in the Section 2.0 table. This Model System will be mounted on an existing NASA jet noise rig and will exhaust hot gases up to 1200°F and pressures up to 40psi.

1.1 Scope

The Contractor shall provide manufacturing review, and fabrication services as outlined below. The Model Title for this model hardware is Extensible Rectangular Nozzle Model.

1.2 General Description

The Contractor shall complete the fabrication of duct and nozzles as described in this document and in accompanying CAD solid model files. Details of material, manufacturing tolerances and finish are described in this document. The total Model System consists of one adapter duct, three round-to-rectangular ducts, and 15 nozzles.

2. PART DESCRIPTIONS

The Nozzle Model System is grouped into nozzle assemblies that have one of three aspect ratios, 2:1, 4:1, or 8:1. Table 1 specifies the 19 parts to be fabricated for this task, along with file names for the solid model files that give the actual part description. Unigraphics v6 (.prt) models are provided for all current part definitions, and STEP or IGES files will be made available upon request.

TABLE 1 LIST OF PARTS TO BE SUPPLIED

Item	Description	Part ID	File Name
1	SHJAR to TwinJet adapter duct	DS2TJ	
2	Round to rectangular transition duct, 2:1	DR2A2	
3	Round to rectangular transition duct, 4:1	DR2A4	
4	Round to rectangular transition duct, 8:1	DR2A8	
5	Baseline rect nozzle, 2:1	NA2Z	
6	Baseline rect nozzle, 4:1	NA4Z	
7	Baseline rect nozzle, 8:1	NA8Z	
8	Bevel nozzle, 2:1, 1.3" ext	NA2B1	
9	Bevel nozzle, 2:1, 2.7" ext	NA2B2	
10	Bevel nozzle, 4:1, 1.3" ext	NA4B1	
11	Bevel nozzle, 4:1, 2.7" ext	NA4B2	
12	Bevel nozzle, 8:1, 1.3" ext	NA8B1	
13	Bevel nozzle, 8:1, 2.7" ext	NA8B2	
14	Cutback nozzle, 2:1, 1.3" ext	NA2K1	
15	Cutback nozzle, 4:1, 1.3" ext	NA4K1	
16	Chevron nozzle, 2:1, design 1	NA2C1	
17	Chevron nozzle, 2:1, design 2	NA2C2	
18	Chevron nozzle, 2:1, design 3	NA2C3	



19	Bevel nozzle w/chevron, 2:1, design 1	NA2BC1	
20	Fasteners for two assemblies	FASTEN	--

2.1 Additional description of parts

2.1.1 DS2TJ, SHJAR to TwinJet adapter duct

Reference views of the part are given in Figure 1. Reference cross-sections detailing flange holes are given in Figure 2. Details from drawings of upstream flange and downstream flange of existing similar parts are given in Figure 3 and Figure 4, respectively, for reference. Inspection points are given in Table 2.

Nominal dimensions:

Upstream flange external diameter = 8.25".

Upstream flange internal diameter = 6.0".

Downstream flange external diameter = 5.0".

Downstream flange internal diameter = 3.5".

Length = 4.963".

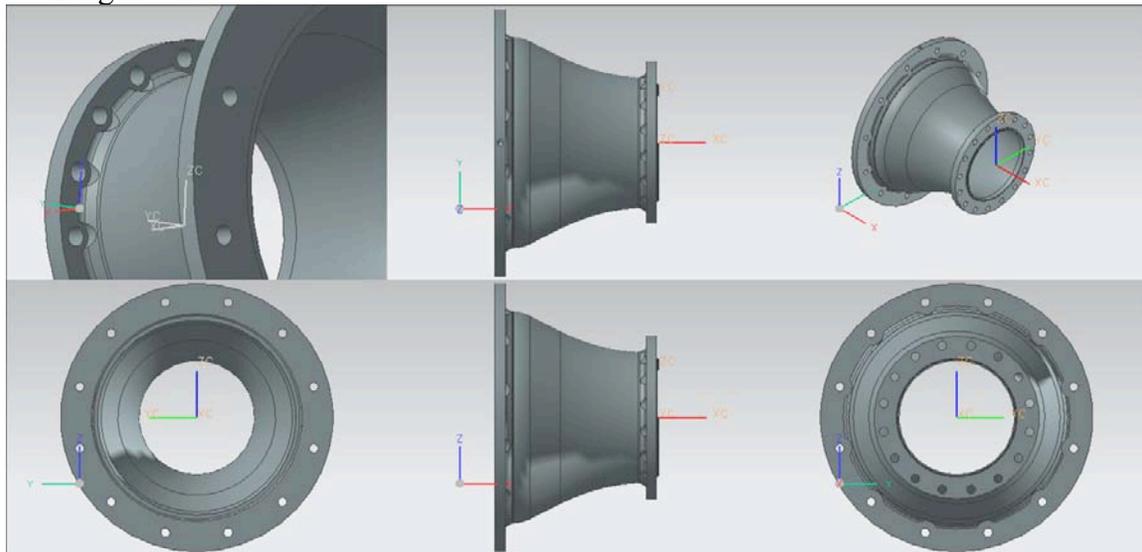


FIGURE 1 PARTID DS2TJ-SIX VIEWS

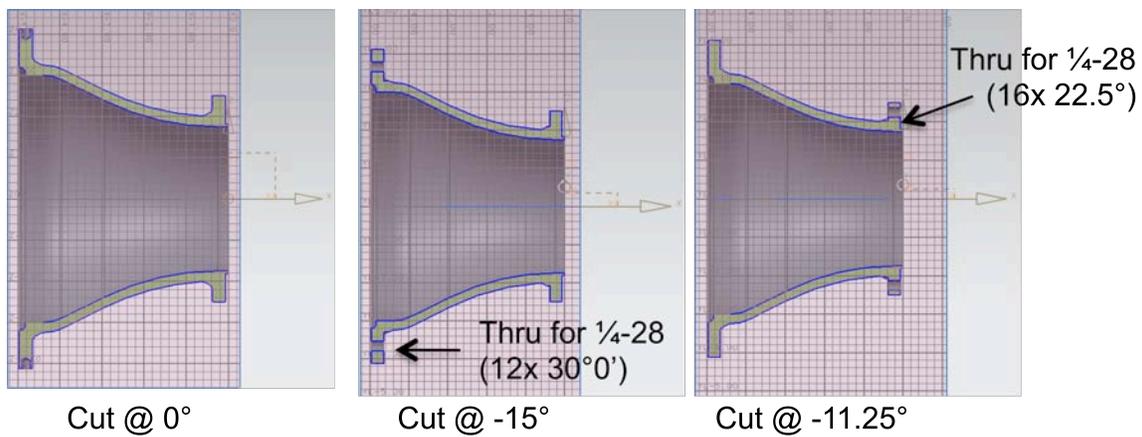


FIGURE 2 PARTID DS2TJ—REFERENCE CROSS-SECTION.

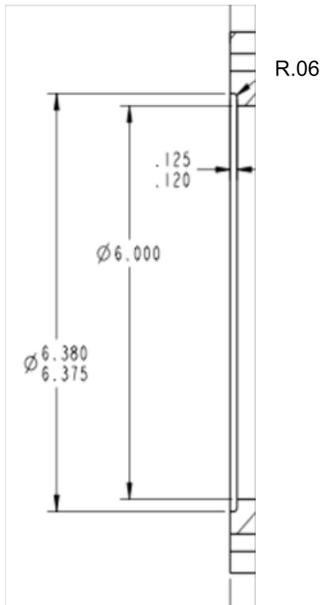


FIGURE 3 PARTID DS2TJ—REFERENCE DRAWING OF UPSTREAM FLANGE DETAILS FROM SIMILAR PART

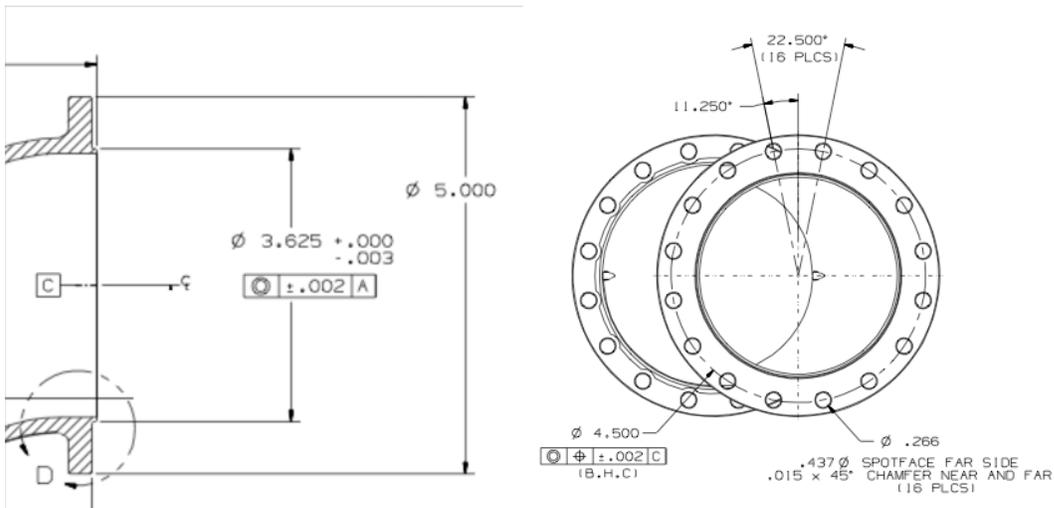


FIGURE 4 PARTID DS2TJ—REFERENCE DRAWING OF DOWNSTREAM FLANGE DETAILS FROM SIMILAR PART

TABLE 2 INSPECTION POINTS FOR PARTID DS2TJ

DS2TJ					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.000	0.000	±3.188 (radius)	0.000	0.000	±4.125 (radius)
0.200	0.000	±3.000 (radius)	4.928	0.000	±1.812 (radius)
1.000	0.000	±2.899 (radius)			
4.000	0.000	±1.792 (radius)			



4.963(end)	0.000	±1.750 (radius)
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2.1.2 DR2A2, Round to rectangular transition duct, 2:1

Views of the part are given in Figure 5. Reference cross-sections pointing out location of Helicoils and critical angle are shown in Figure 6. Details from drawings of upstream flange of existing similar parts are given in Figure 7 for reference.

Inspection points are given in Table 3.

Nominal dimensions:

Upstream external diameter = 5.0”

Upstream internal diameter = 3.5”

Max included diameter (centered about x-axis) = 5.20”

Length = 2.740”

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Stainless Helicoil fasteners ¼-28 0.375” deep (Helicoil Part 1191-4CN375) will be used in the threaded holes on the upstream flange and will be bottomed in the holes. The holes must not break the outer surface of the ducts.

External 10° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

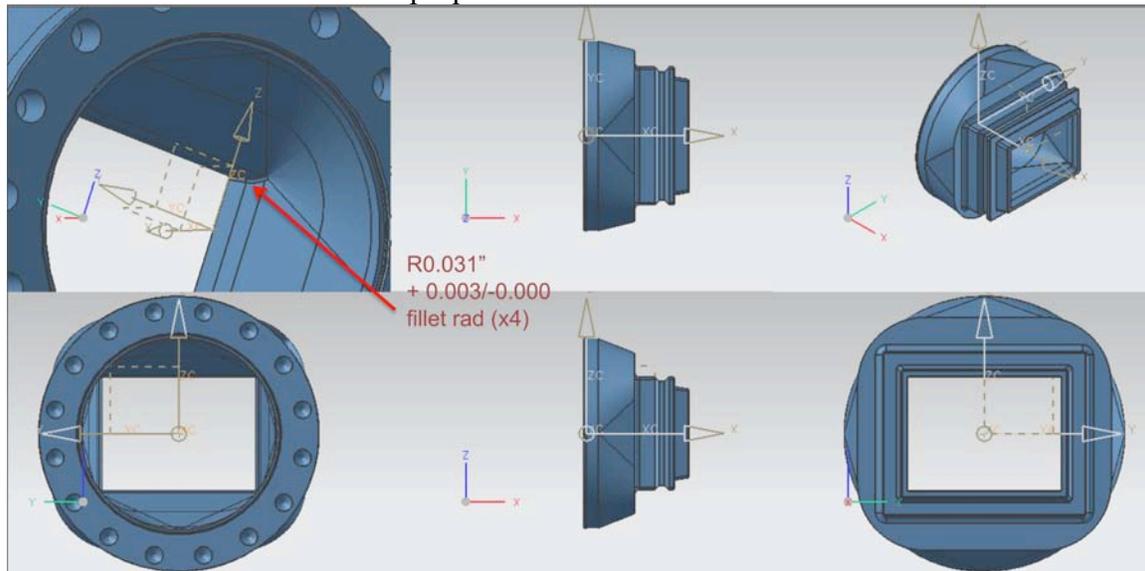


FIGURE 5 PARTID DR2A2—SIX VIEWS

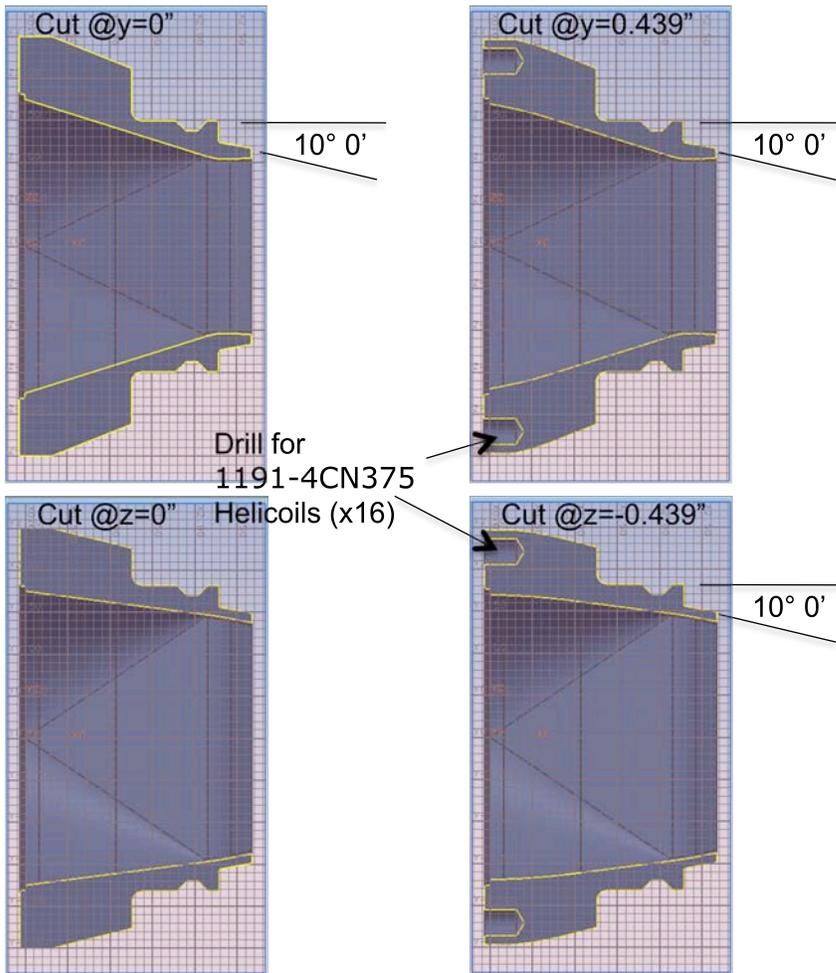


FIGURE 6 PARTID D2A2—REFERENCE CROSS-SECTIONS

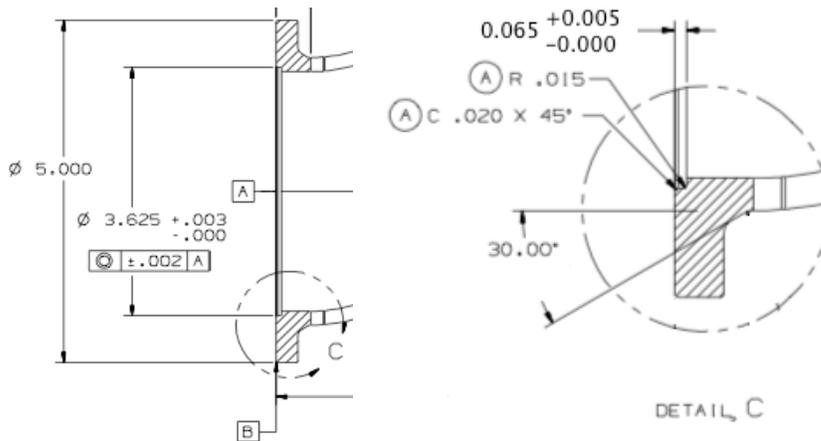


FIGURE 7 PARTID D2A2—REFERENCE DRAWING OF UPSTREAM FLANGE DETAILS FROM SIMILAR PART



TABLE 3 INSPECTION POINTS FOR PARTID DR2A2

DR2A2					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.035	0.000	±1.813	2.440	0.000	±1.221
0.080	0.000	±1.745	2.700	0.000	±1.175
2.200	0.000	±1.074	2.440	±1.543	0.000
2.500	0.000	±1.037	2.700	±1.497	0.000
2.740 (end)	0.000	±1.053			
0.035	±1.813	0.000			
0.080	±1.748	0.000			
2.200	±1.471	0.000			
2.500	±1.422	0.000			
2.740 (end)	±1.375	0.000			



2.1.3 DR2A4, Round to rectangular transition duct, 4:1

Views of the part are given in Figure 8. Reference cross-sections pointing out location of Helicoils and critical angle are shown in Figure 9. Drawing detailing upstream flange (Figure 7) from an existing similar part is given for reference.

Inspection points are given in Table 4.

Nominal dimensions:

Upstream external diameter = 5.0 ”.

Upstream internal diameter = 3.5”.

Max included diameter (centered about x-axis) = ~5.84”.

Length = 3.900”.

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Stainless Helicoil fasteners ¼-28 0.375” deep (Helicoil Part 1191-4CN375) will be used in the threaded holes on the upstream flange and will be bottomed in the holes. The holes must not break the outer surface of the ducts.

External 10° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

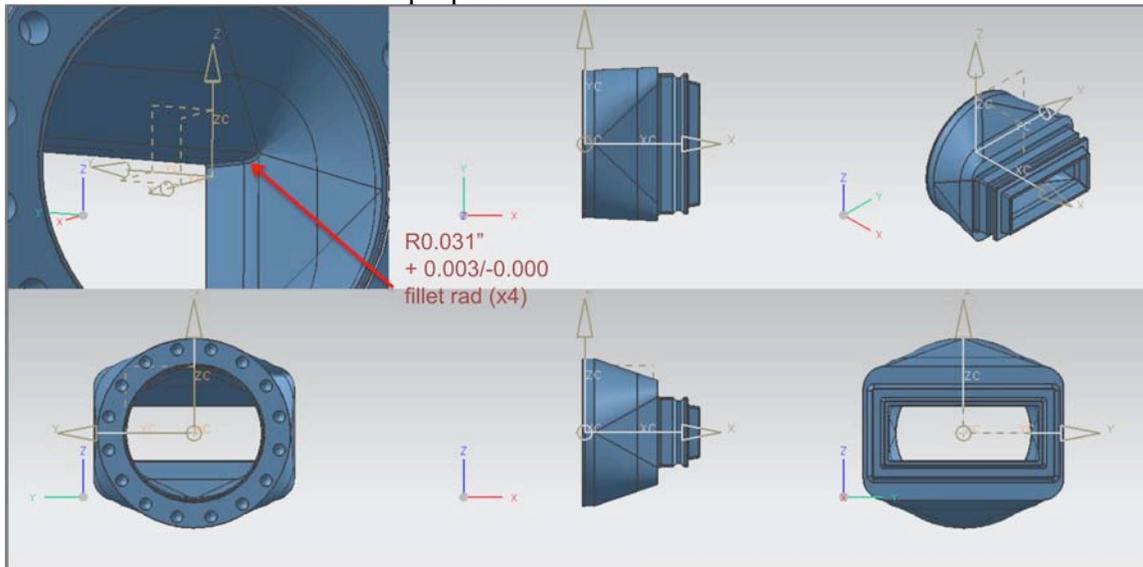


FIGURE 8 PARTID DR2A4--SIX VIEWS

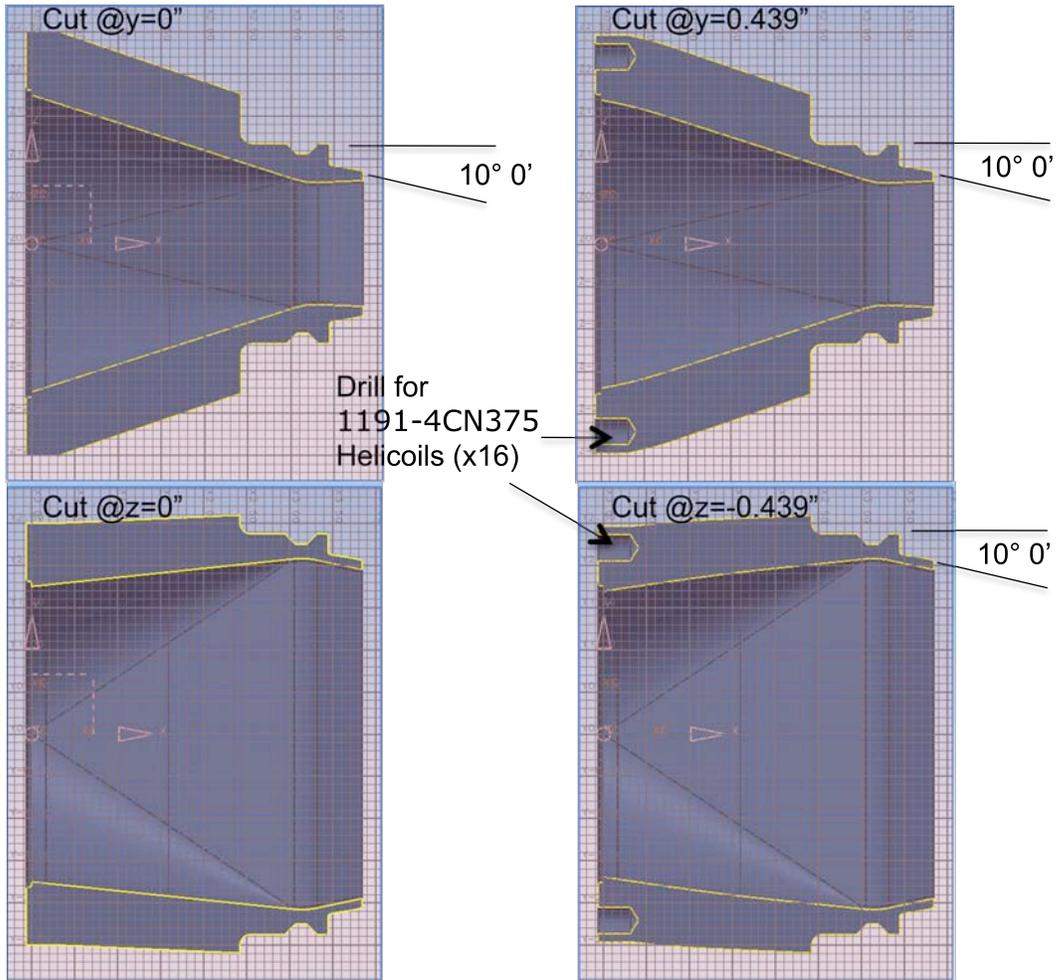


FIGURE 9 PARTID DR2A4—REFERENCE CROSS-SECTIONS

TABLE 4 INSPECTION POINTS FOR PARTID DR2A4

DR2A4					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.035	0.000	±1.813	3.600	0.000	±0.910
0.080	0.000	±1.745	3.860	0.000	±0.864
3.000	0.000	±0.792	3.600	±2.118	0.000
3.500	0.000	±0.725	3.860	±2.079	0.000
3.900 (end)	0.000	±0.742			
0.035	±1.813	0.000			
0.080	±1.752	0.000			
3.000	±2.064	0.000			
3.500	±2.035	0.000			
3.900 (end)	±1.950	0.000			



2.1.4 DR2A8, Round to rectangular transition duct, 8:1

Views of the part are given in Figure 10. Reference cross-sections pointing out location of Helicoils and critical angle are shown in Figure 11. Drawing detailing upstream flange (Figure 7) from an existing similar part is given for reference.

Inspection points are given in Table 5.

Nominal dimensions:

Upstream external diameter = 5.0”.

Upstream internal diameter = 3.5”.

Max included diameter (centered about x-axis) = ~7.066”.

Length = 5.389”.

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Stainless Helicoil fasteners ¼-28 0.375” deep (Helicoil Part 1191-4CN375) will be used in the threaded holes on the upstream flange and will be bottomed in the holes. The holes must not break the outer surface of the ducts.

External 10° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

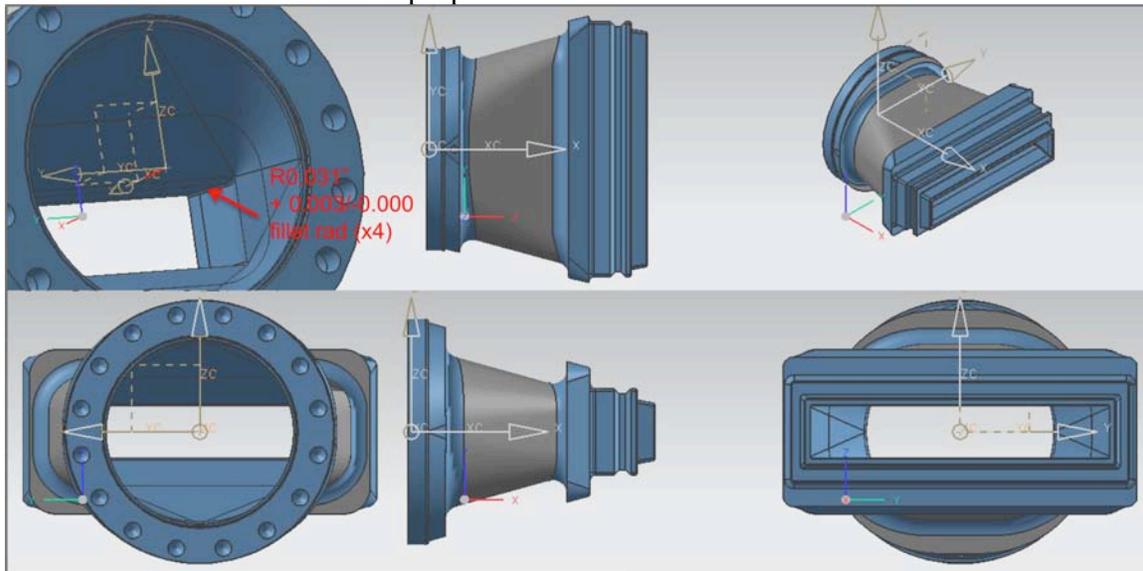


FIGURE 10 PARTID DR2A8—SIX VIEWS

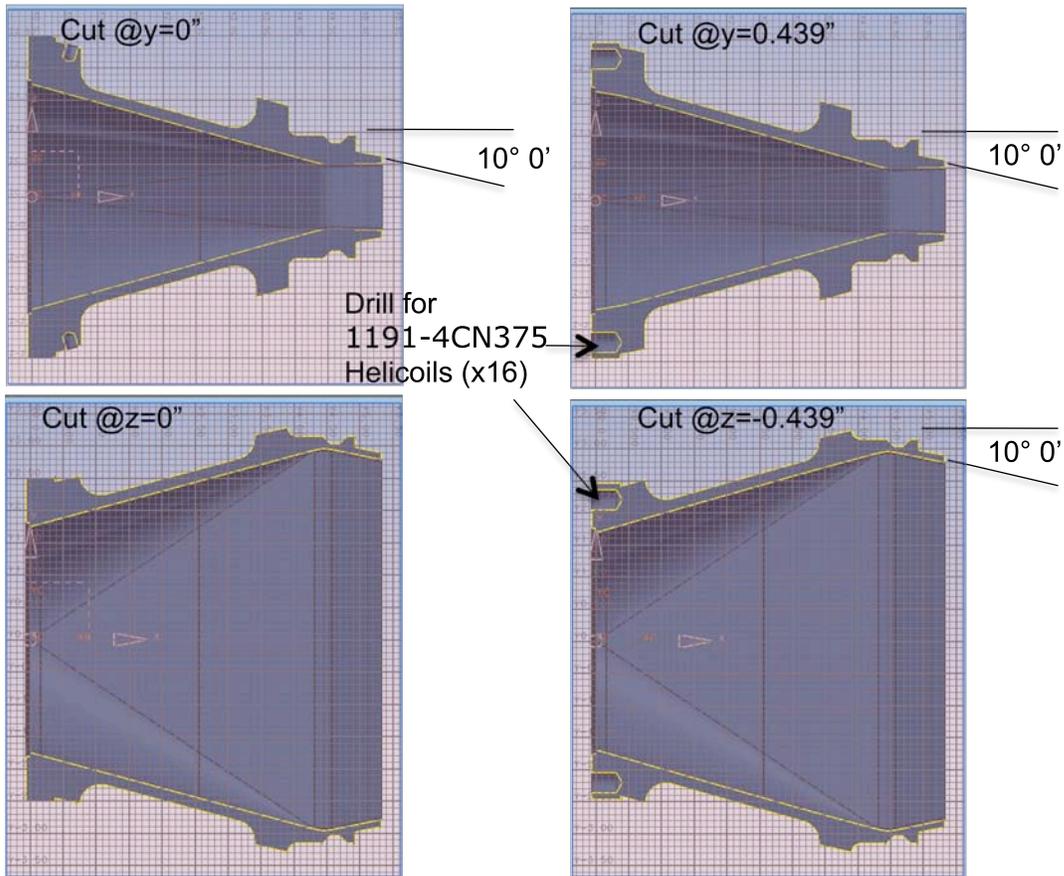


FIGURE 11 PARTID DR2A8—REFERENCE CROSS-SECTIONS

TABLE 5 INSPECTION POINTS FOR PARTID DR2A8

DR2A8					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.035	0.000	±1.813	5.089	0.000	±0.687
0.080	0.000	±1.746	5.349	0.000	±0.641
0.250	0.000	±1.698	5.089	±2.956	0.000
4.350	0.000	±0.541	5.349	±2.911	0.000
4.650	0.000	±0.501			
5.389 (end)	0.000	±0.519			
0.035	±1.813	0.000			
0.080	±1.754	0.000			
0.250	±1.801	0.000			
4.350	±2.929	0.000			
4.650	±2.943	0.000			
5.389 (end)	±2.788	0.000			



2.1.5 NA2Z, Baseline rectangular nozzle, 2:1

Views of the part are given in Figure 12. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 13.

Inspection points are given in Table 6.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38”

Length = 3.431”

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

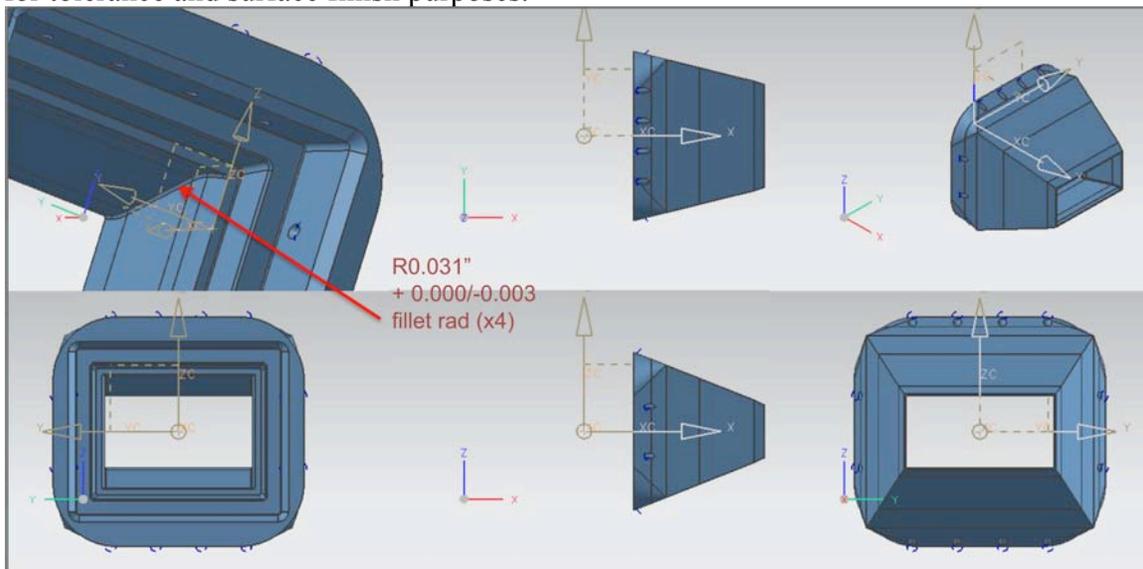


FIGURE 12 PARTID NA2Z—SIX VIEWS

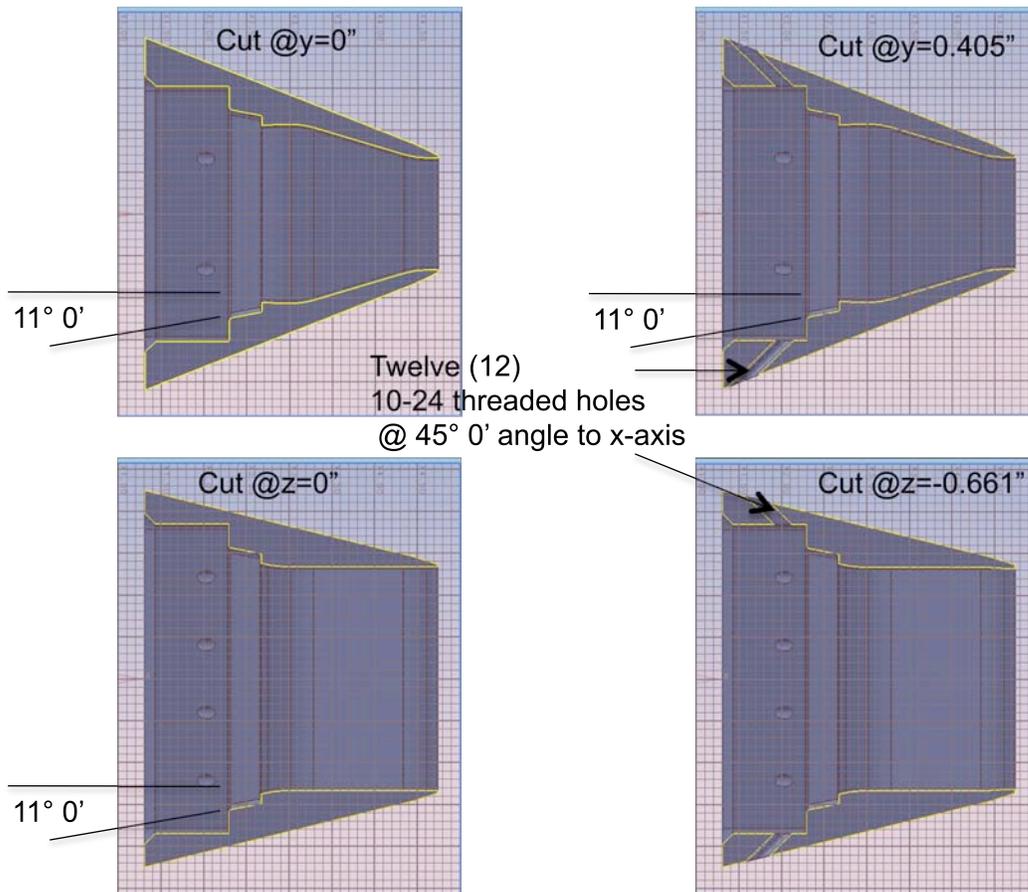


FIGURE 13 PARTID NA2Z—REFERENCE CROSS-SECTIONS

TABLE 6 INSPECTION POINTS FOR PARTID NA2Z

NA2Z					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	±1.697
1.100	0.000	±1.221	2.931	0.000	±0.922
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.513	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431 (end)	0.000	±0.667			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			
3.000	±1.335	0.000			
3.231	±1.335	0.000			
3.431 (end)	±1.335	0.000			



2.1.6 NA4Z, Baseline rectangular nozzle, 4:1

Views of the part are given in Figure 14. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 15.

Inspection points are given in Table 7.

Nominal dimensions:

Max included diameter (centered about x-axis) = 6.063”

Length = 3.520”

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

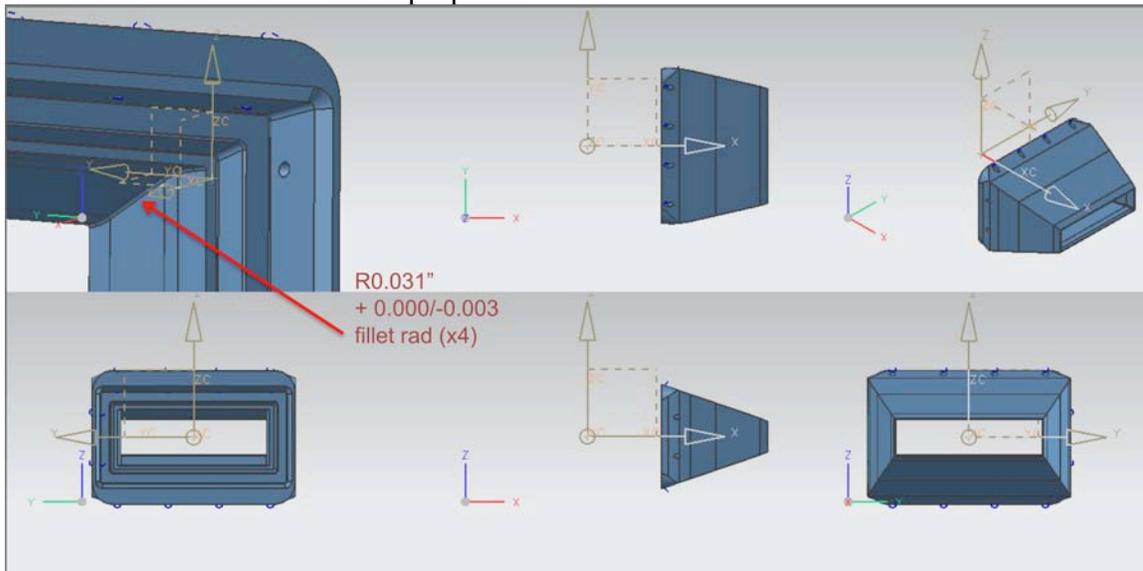


FIGURE 14 PARTID NA4Z—SIX VIEWS

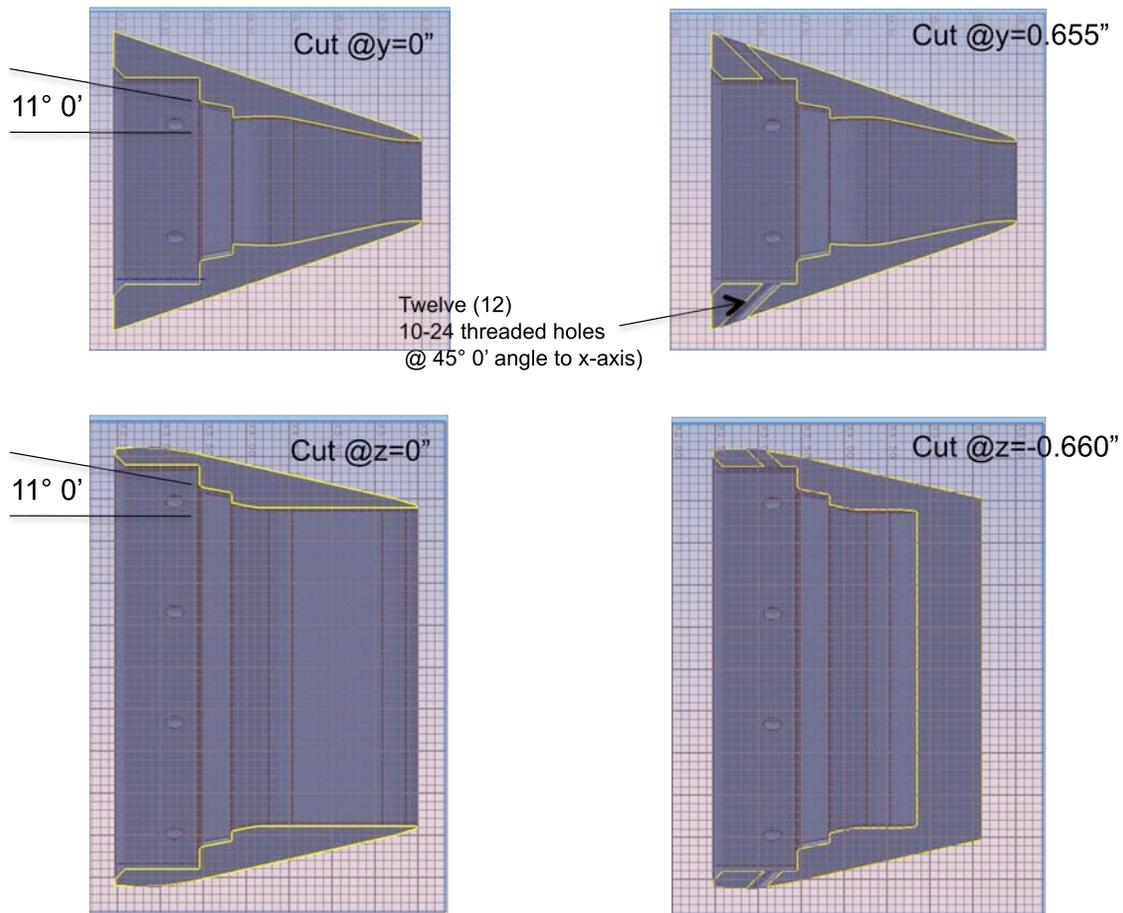


FIGURE 15 PARTID NA4Z—REFERENCE CROSS-SECTIONS

TABLE 7 INSPECTION POINTS FOR PARTID NA4Z

NA4Z					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.211	1.000	0.000	±1.402
1.100	0.000	±0.910	3.020	0.000	±0.699
1.300	0.000	±0.871	1.000	±2.524	0.000
1.400	0.000	±0.744	3.020	±2.056	0.000
1.800	0.000	±0.756			
3.100	0.000	±0.505			
3.320	0.000	±0.474			
3.520 (end)	0.000	±0.472			
0.200	±2.402	0.000			
1.100	±2.118	0.000			
1.300	±2.454	0.000			
1.400	±1.943	0.000			
1.800	±1.887	0.000			
3.100	±1.887	0.000			
3.320	±1.887	0.000			
3.520 (end)	±1.887	0.000			



2.1.7 NA8Z, Baseline rectangular nozzle, 8:1

Views of the part are given in Figure 16. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 17.

Inspection points are given in Table 8.

Nominal dimensions:

Max included diameter (centered about x-axis) = 7.325"

Length = 3.799"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

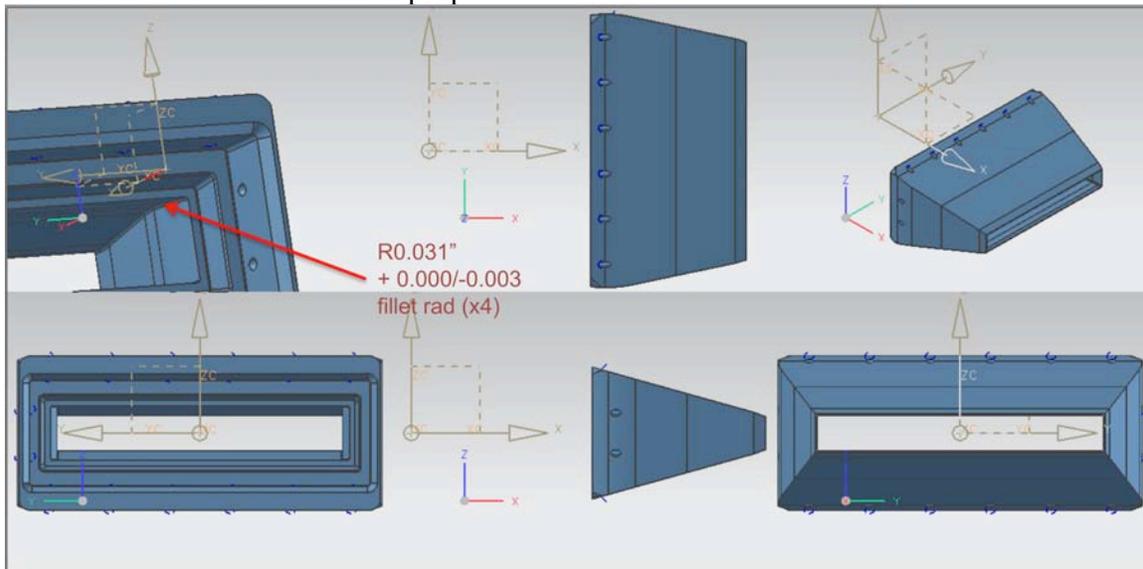


FIGURE 16 PARTID NA8Z—SIX VIEWS

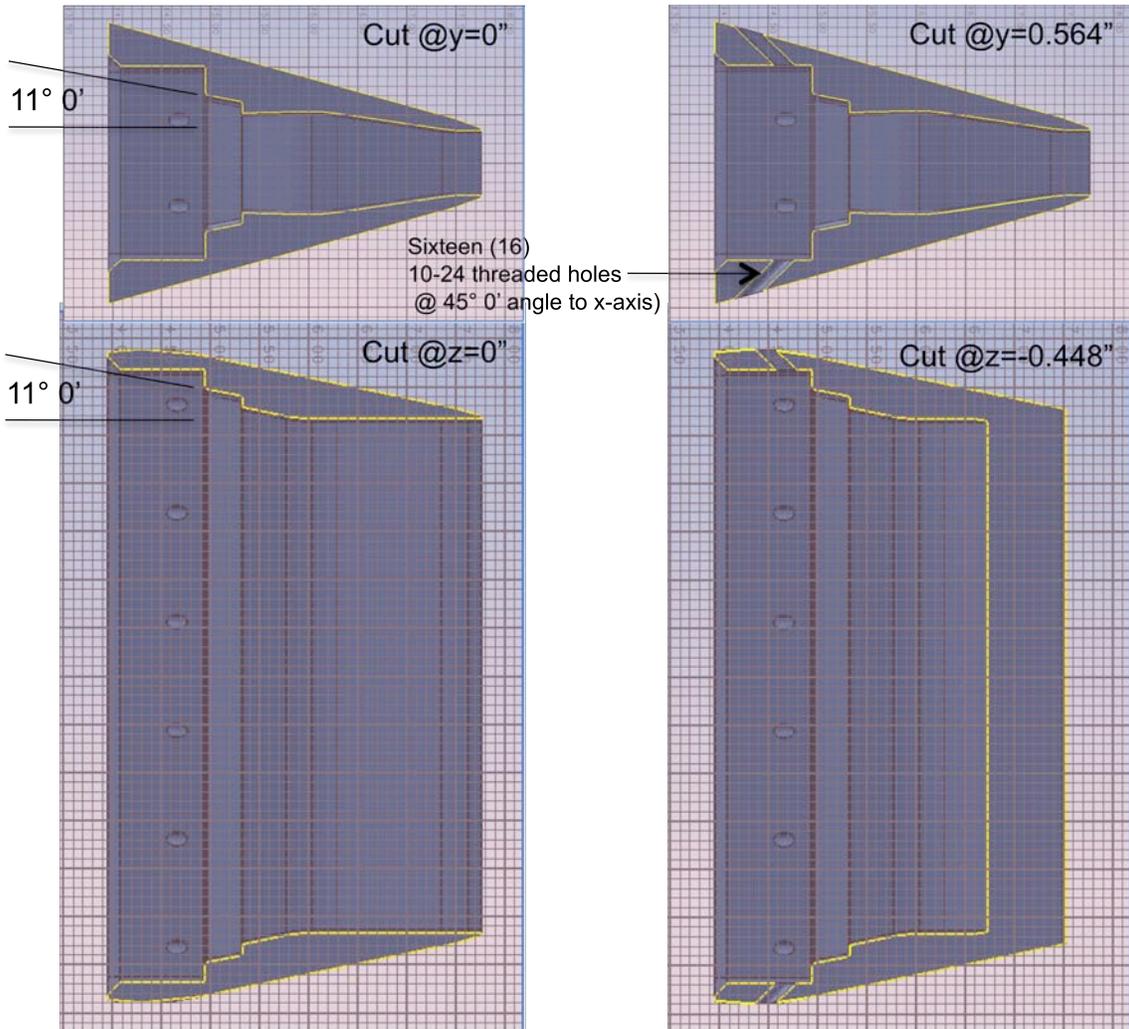


FIGURE 17 PARTID NA8Z—REFERENCE CROSS-SECTIONS

TABLE 8 INSPECTION POINTS FOR PARTID NA8Z

NA8Z					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.009	1.000	0.000	±1.181
1.100	0.000	±0.687	3.299	0.000	±0.529
1.300	0.000	±0.648	1.000	±3.320	0.000
1.400	0.000	±0.520	3.299	±2.829	0.000
2.100	0.000	±0.534			
3.300	0.000	±0.369			
3.599	0.000	±0.335			
3.799 (end)	0.000	±0.334			
0.200	±3.184	0.000			
1.100	±2.956	0.000			
1.300	±2.917	0.000			
1.400	±2.782	0.000			
2.100	±2.669	0.000			



3.300	± 2.669	0.000
3.599	± 2.669	0.000
3.799 (end)	± 2.669	0.000

2.1.8 NA2B1, Bevel nozzle, 2:1,1.3" ext

Views of the part are given in Figure 18. Reference cross-sections pointing out location of threaded holes are shown in Figure 19.

Inspection points are given in Table 9.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38"

Length = 4.766"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

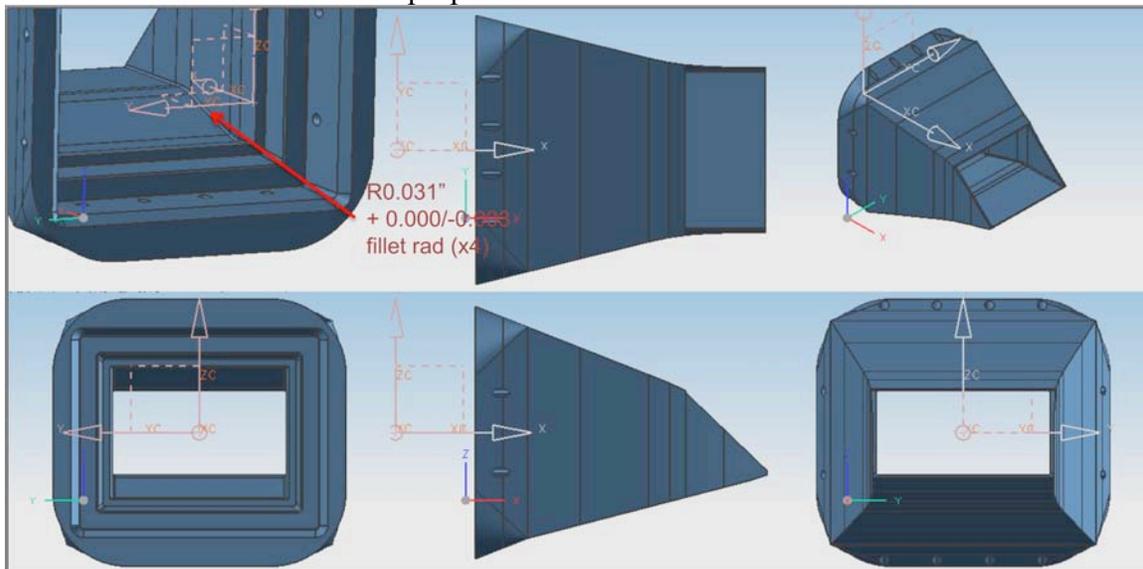


FIGURE 18 PARTID NA2B1—SIX VIEWS

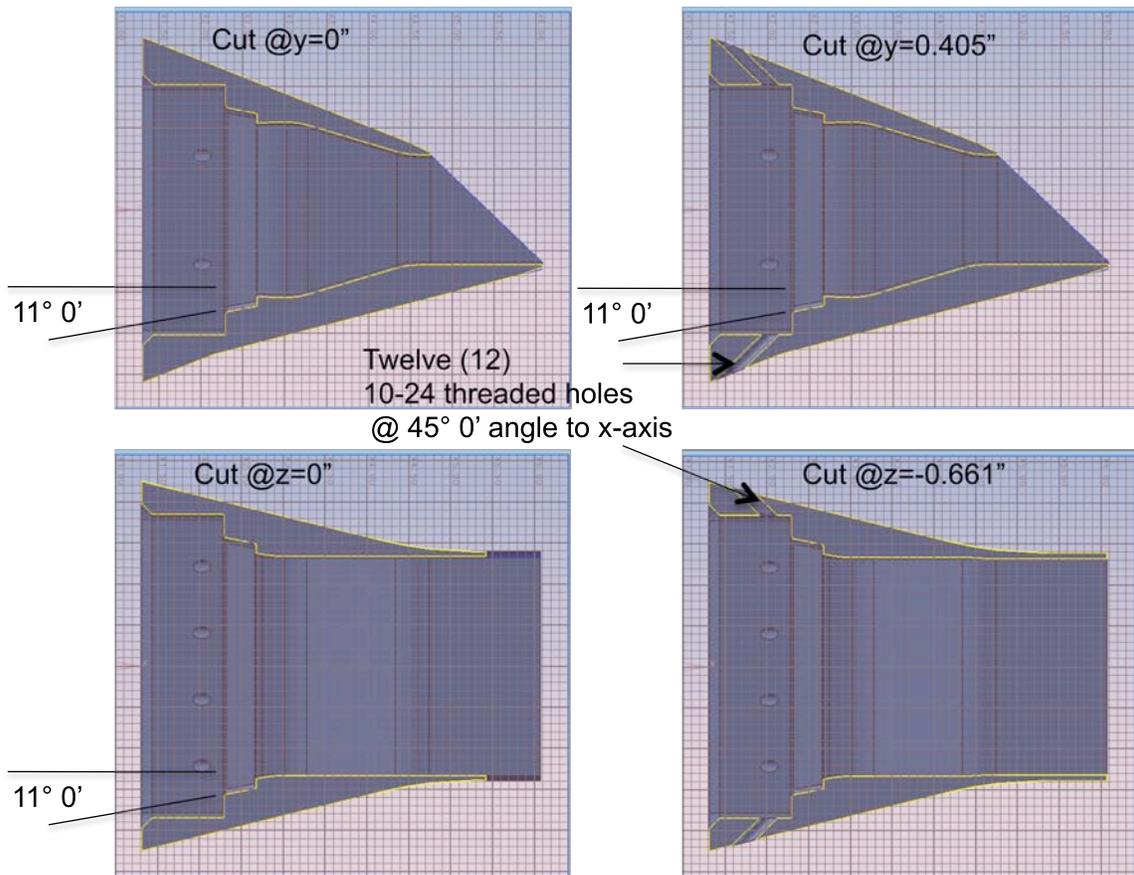


FIGURE 19 PARTID NA2B1—REFERENCE CROSS-SECTION

TABLE 9 INSPECTION POINTS FOR PARTID NA2B1

NA2B1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	1.697 -1.718
1.100	0.000	±1.221	2.931	0.000	0.922 -1.207
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.514	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			
3.000	±1.335	0.000			
3.231	±1.335	0.000			
3.431	±1.335	0.000			



2.1.9 NA2B2, Bevel nozzle, 2:1, 2.7" ext

Views of the part are given in Figure 20. Reference cross-sections pointing out location of threaded holes are shown in Figure 21.

Inspection points are given in Table 10.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38"

Length = 6.100"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

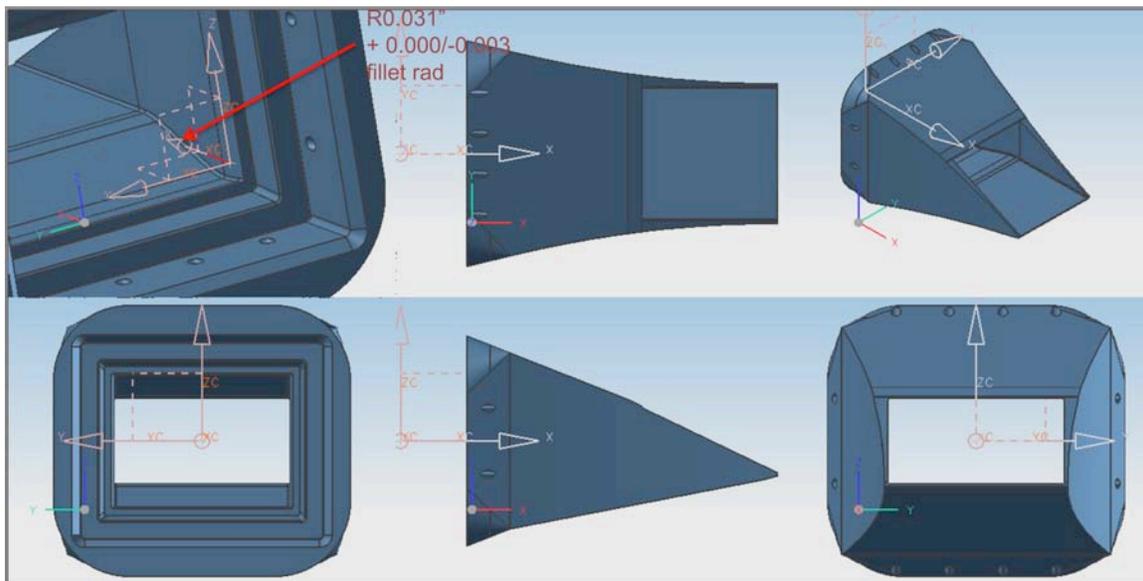


FIGURE 20 PARTID NA2B2—SIX VIEWS

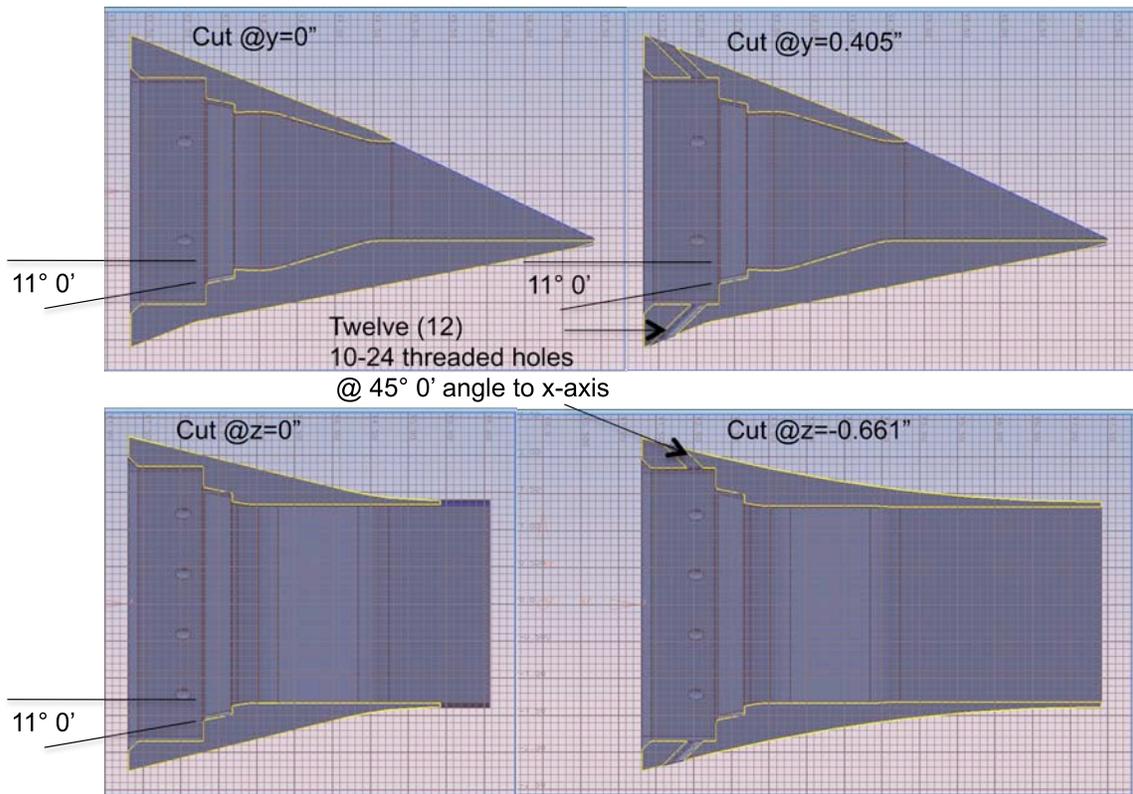


FIGURE 21 PARTID NA2B2—REFERENCE CROSS-SECTION

TABLE 10 INSPECTION POINTS FOR PARTID NA2B2

NA2B2					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	1.697 -1.729
1.100	0.000	±1.221	2.931	0.000	0.922 -1.347
1.300	0.000	±1.182	1.000	±1.999	0.000
1.400	0.000	±1.056	2.931	±1.622	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			
3.000	±1.335	0.000			
3.231	±1.335	0.000			
3.431	±1.335	0.000			



2.1.10 NA4B1, Bevel nozzle, 4:1, 1.3" ext

Views of the part are given in Figure 22. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 23.

Inspection points are given in Table 11.

Nominal dimensions:

Max included diameter (centered about x-axis) = 6.063"

Length = 4.854"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

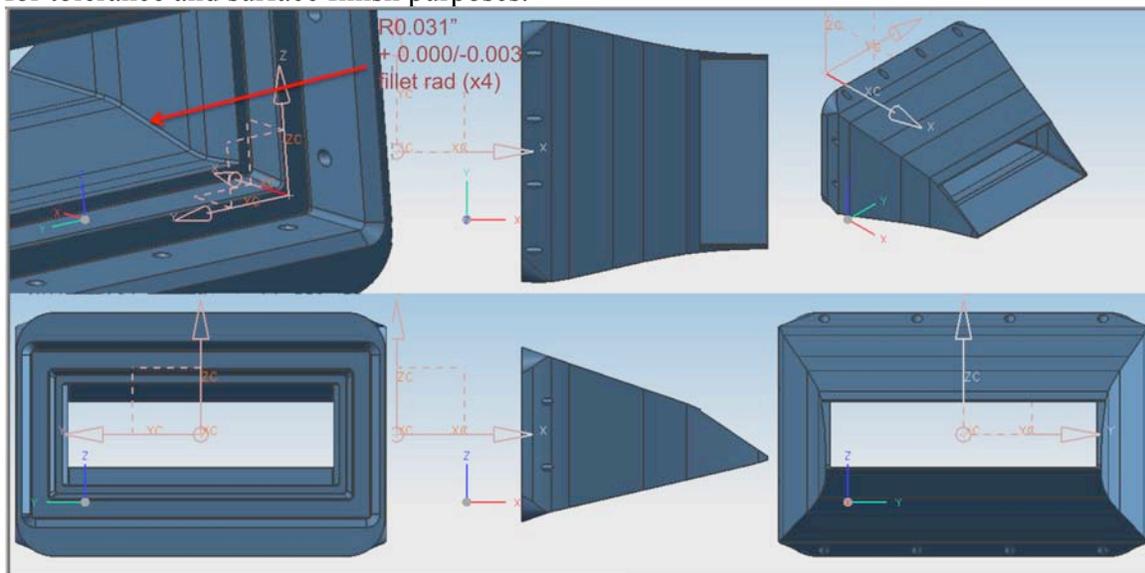


FIGURE 22 PARTID NA4B1—SIX VIEWS

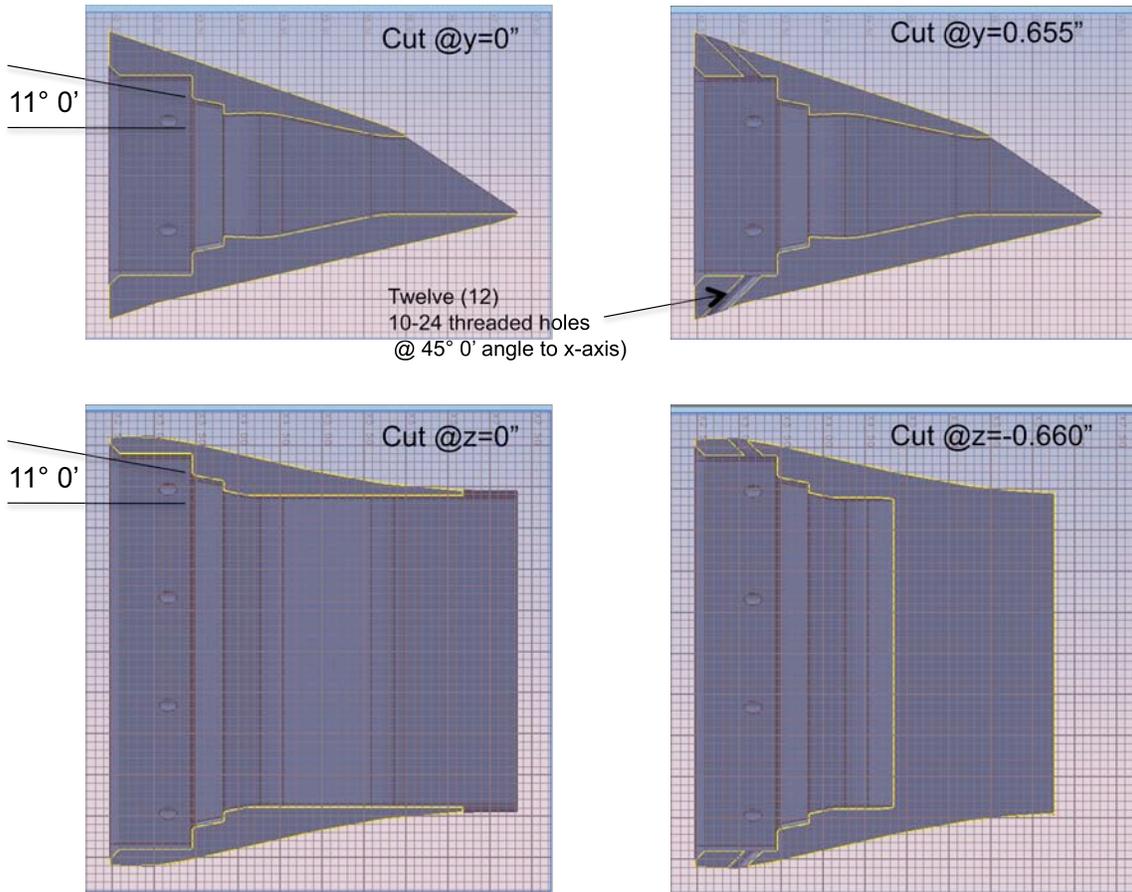


FIGURE 23 PARTID NA4B1—REFERENCE CROSS-SECTION

TABLE 11 INSPECTION POINTS FOR PARTID NA4B1

NA4B1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.211	1.000	0.000	1.402
					-1.448
1.100	0.000	±0.910	3.020	0.000	0.699
1.300	0.000	±0.871	1.000	±2.524	0.000
1.400	0.000	±0.744	3.020	±2.076	0.000
1.800	0.000	±0.756			
3.100	0.000	±0.505			
3.320	0.000	±0.474			
3.520	0.000	±0.472			
0.200	±2.402	0.000			
1.100	±2.118	0.000			
1.300	±2.454	0.000			
1.400	±1.943	0.000			
1.800	±1.887	0.000			
3.100	±1.887	0.000			
3.320	±1.887	0.000			
3.520	±1.887	0.000			



2.1.11 NA4B2, Bevel nozzle, 4:1, 2.7" ext

Views of the part are given in Figure 24. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 25.

Inspection points are given in Table 12.

Nominal dimensions:

Max included diameter (centered about x-axis) = 6.063"

Length = 6.189"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

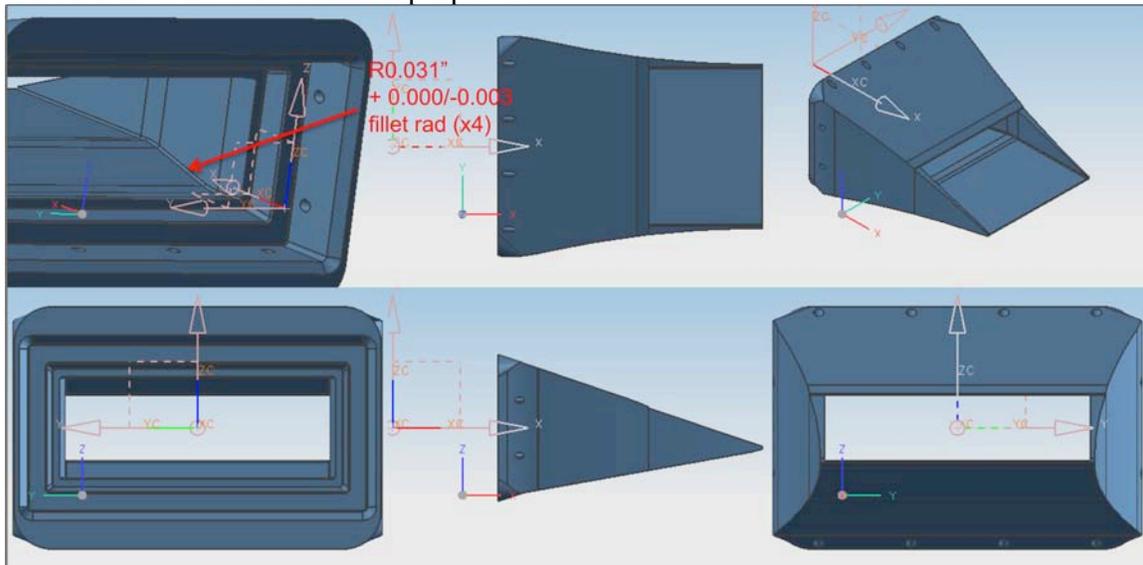


FIGURE 24 PARTID NA4B2—SIX VIEWS

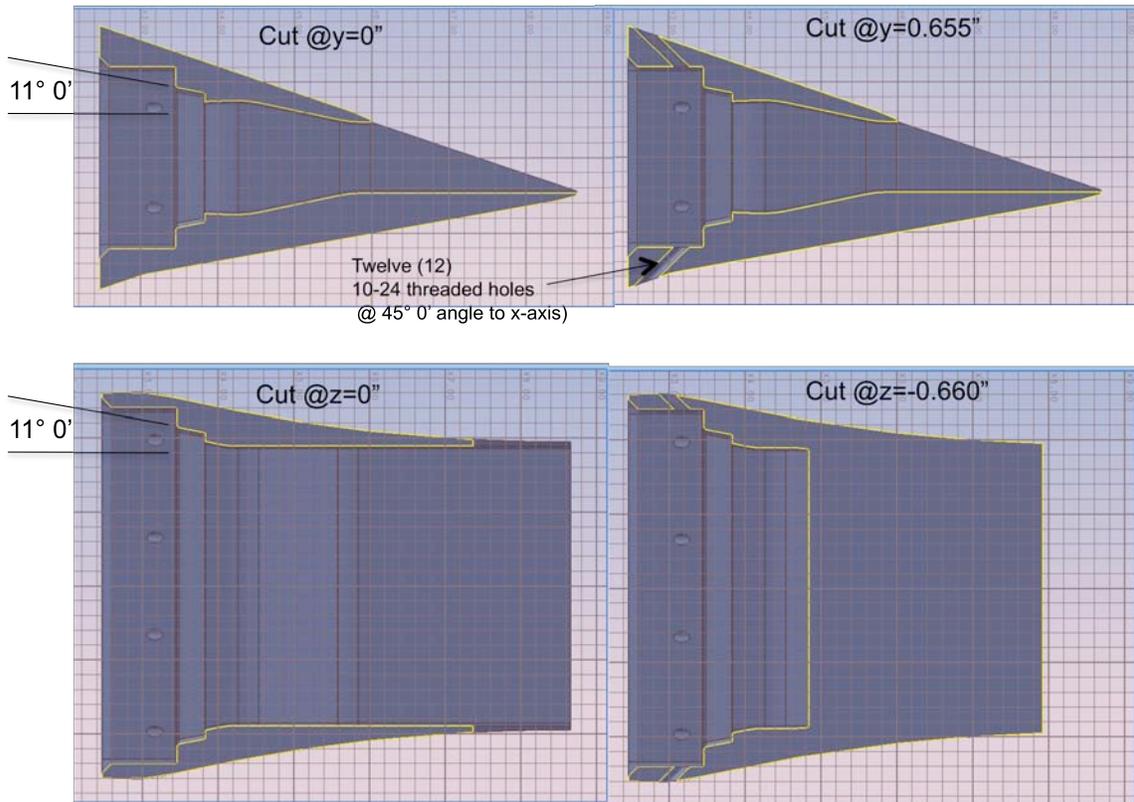


FIGURE 25 PARTID NA4B2—REFERENCE CROSS-SECTION

TABLE 12 INSPECTION POINTS FOR PARTID NA4B2

NA4B2					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.211	1.000	0.000	1.402 -1.472
1.100	0.000	±0.910	3.020	0.000	0.699 -1.103
1.300	0.000	±0.871	1.000	±2.524	0.000
1.400	0.000	±0.744	3.020	±2.155	0.000
1.800	0.000	±0.756			
3.100	0.000	±0.505			
3.320	0.000	±0.474			
3.520	0.000	±0.472			
0.200	±2.402	0.000			
1.100	±2.118	0.000			
1.300	±2.454	0.000			
1.400	±1.943	0.000			
1.800	±1.887	0.000			
3.100	±1.887	0.000			
3.320	±1.887	0.000			
3.520	±1.887	0.000			



2.1.12 NA8B1, Bevel nozzle, 8:1, 1.3" ext

Views of the part are given in Figure 26. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 27.

Inspection points are given in Table 13.

Nominal dimensions:

Max included diameter (centered about x-axis) = 7.325"

Length = 5.134"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

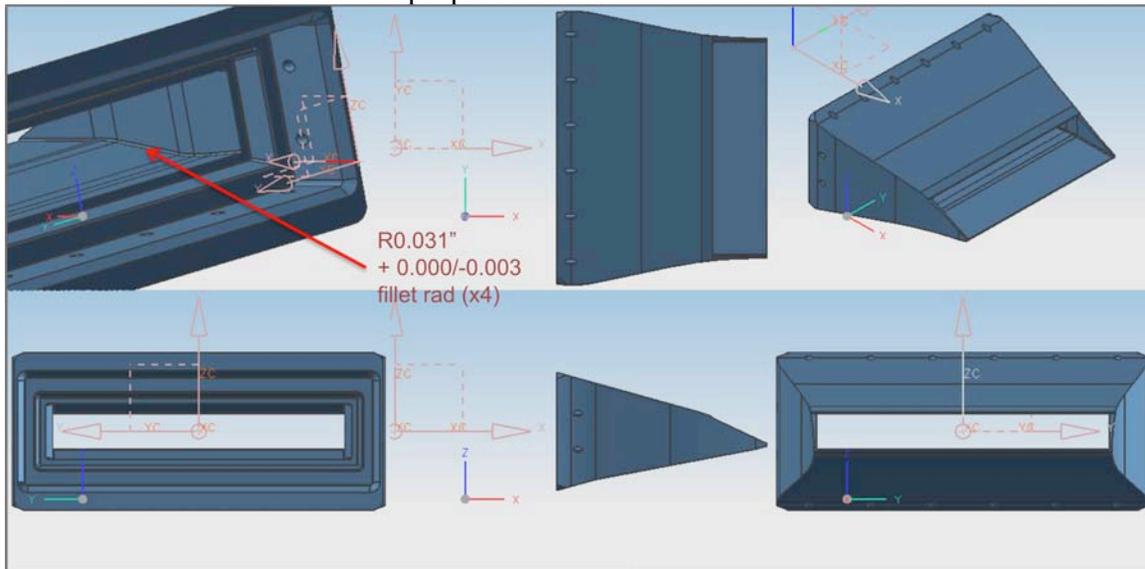


FIGURE 26 PARTID NA8B1—SIX VIEWS

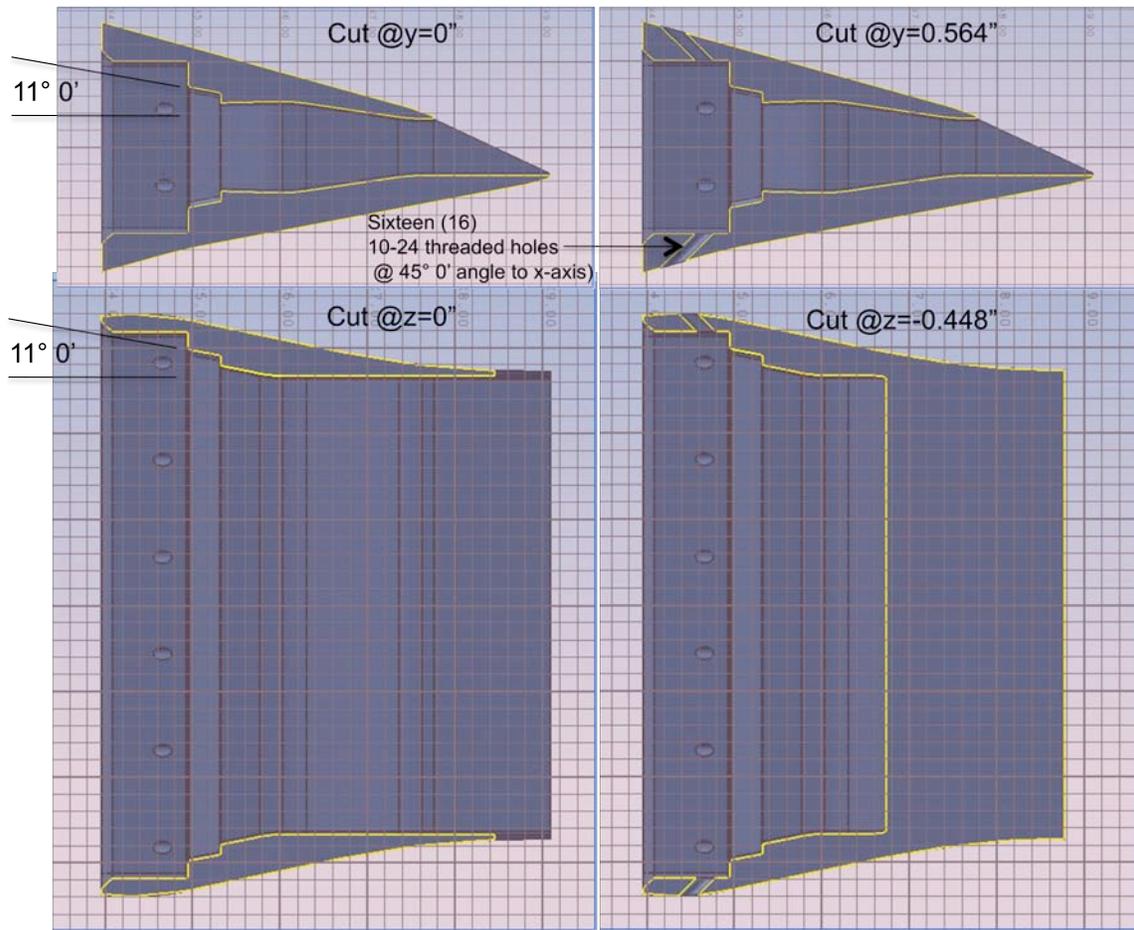


FIGURE 27 PARTID NA8B1—REFERENCE CROSS-SECTION

TABLE 13 INSPECTION POINTS FOR PARTID NA8B1

NA8B1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.009	1.000	0.000	1.181 -1.188
1.100	0.000	±0.687	3.299	0.000	0.529 -0.742
1.300	0.000	±0.648	1.000	±3.320	0.000
1.400	0.000	±0.520	3.299	±2.844	0.000
2.100	0.000	±0.534			
3.300	0.000	±0.369			
3.599	0.000	±0.335			
3.799	0.000	±0.334			
0.200	±3.184	0.000			
1.100	±2.956	0.000			
1.300	±2.917	0.000			
1.400	±2.782	0.000			
2.100	±2.669	0.000			
3.300	±2.669	0.000			
3.599	±2.669	0.000			



3.799	± 2.669	0.000
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2.1.13 NA8B2, Bevel nozzle, 8:1, 2.7" ext

Views of the part are given in Figure 28. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 29.

Inspection points are given in Table 14.

Nominal dimensions:

Max included diameter (centered about x-axis) = 7.325"

Length = 6.468"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

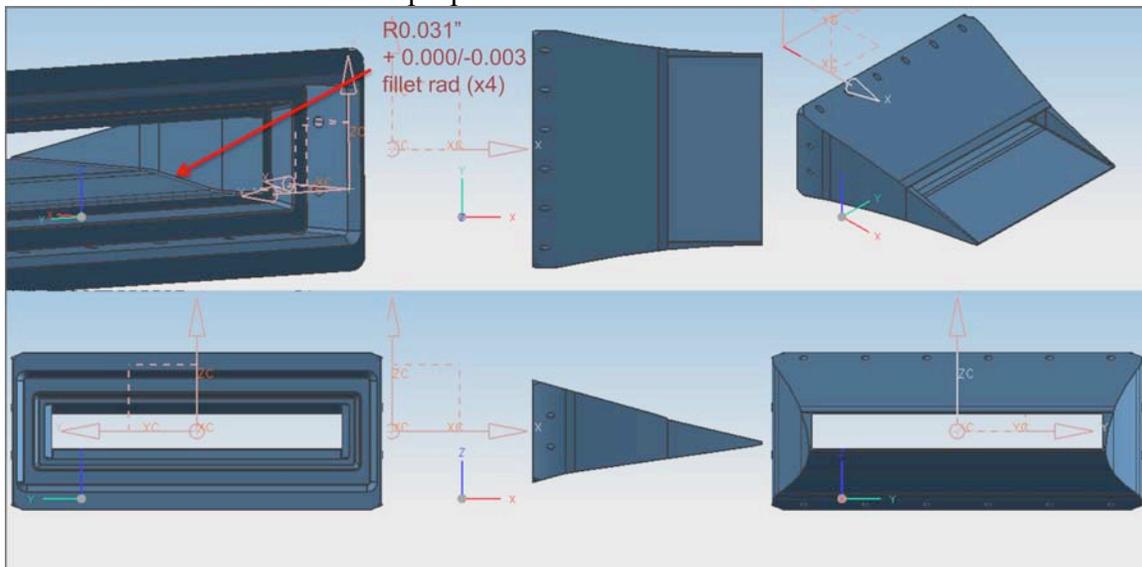


FIGURE 28 PARTID NA8B2—SIX VIEWS

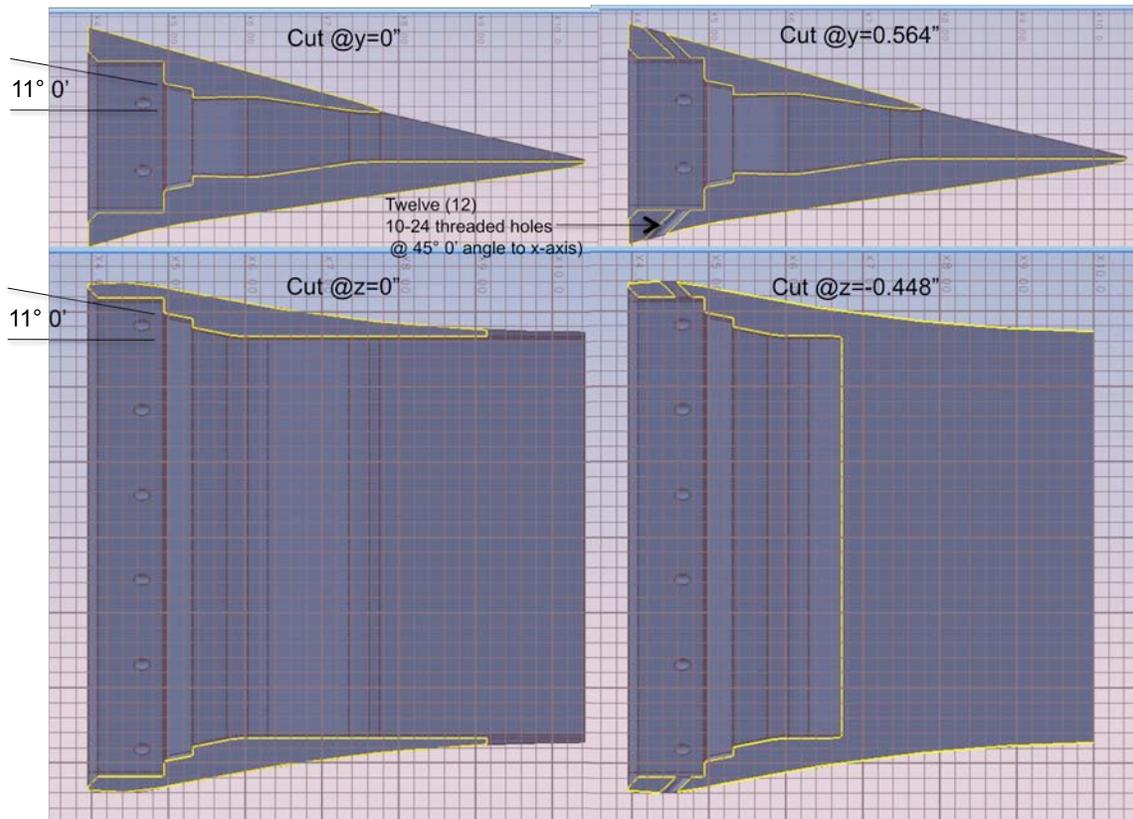


FIGURE 29 PARTID NA8B2—REFERENCE CROSS-SECTIONS

TABLE 14 INSPECTION POINTS FOR PARTID NA8B2

NA8B2					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.009	1.000	0.000	1.181 -1.194
1.100	0.000	±0.687	3.299	0.000	0.529 -0.852
1.300	0.000	±0.648	1.000	±3.320	0.000
1.400	0.000	±0.520	3.299	±2.922	0.000
2.100	0.000	±0.534			
3.300	0.000	±0.369			
3.599	0.000	±0.335			
3.799	0.000	±0.334			
0.200	±3.184	0.000			
1.100	±2.956	0.000			
1.300	±2.917	0.000			
1.400	±2.782	0.000			
2.100	±2.669	0.000			
3.300	±2.669	0.000			
3.599	±2.669	0.000			
3.799	±2.669	0.000			



2.1.14 NA2K1, Cutback nozzle, 2:1, 1.3" ext

Views of the part are given in Figure 30. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 31.

Inspection points are given in Table 15.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38"

Length = 4.766"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface, shown in Reference cross-section, is considered a mating surface for tolerance and surface finish purposes.

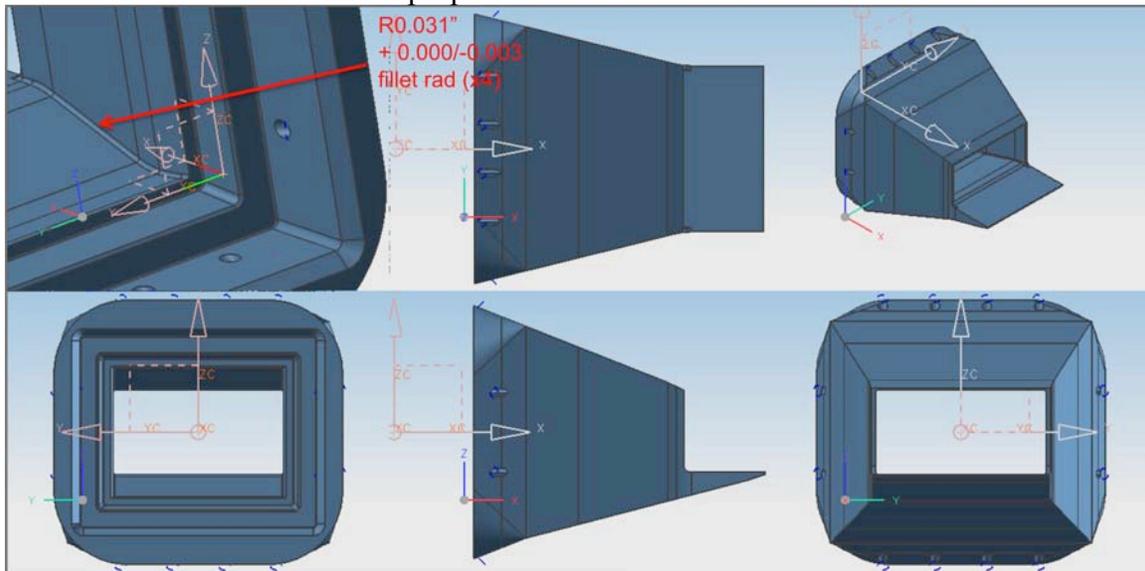


FIGURE 30 PARTID NA2K1—SIX VIEWS

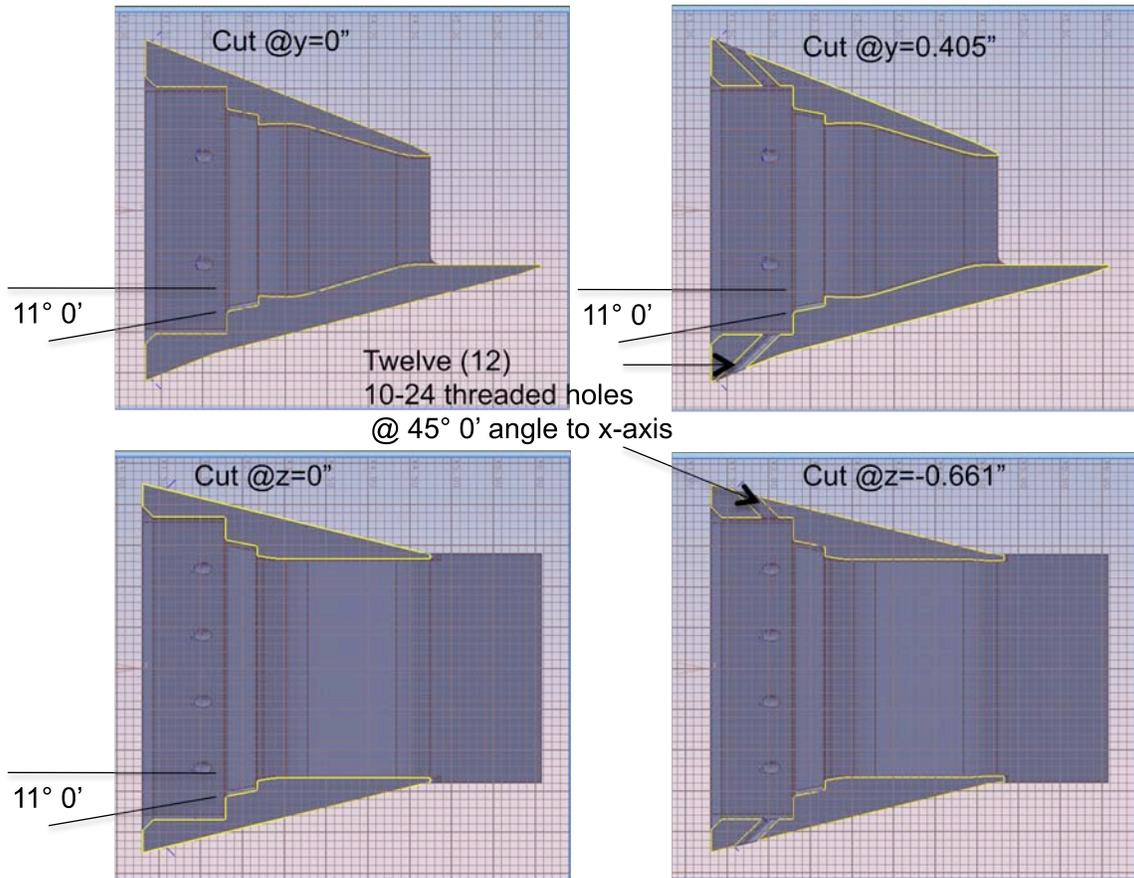


FIGURE 31 PARTID NA2K1—REFERENCE CROSS-SECTIONS

TABLE 15 INSPECTION POINTS FOR PARTID NA2K1

NA2K1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	1.697 -1.718
1.100	0.000	±1.221	2.931	0.000	0.922 -1.207
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.513	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			
3.000	±1.335	0.000			
3.231	±1.335	0.000			
3.431	±1.335	0.000			



2.1.15 NA4K1, Cutback nozzle, 4:1, 1.3" ext

Views of the part are given in Figure 32. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 33.

Inspection points are given in Table 16.

Nominal dimensions:

Max included diameter (centered about x-axis) = 6.063"

Length = 4.854"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface shown in Reference cross-section is considered a mating surface for tolerance and surface finish purposes.

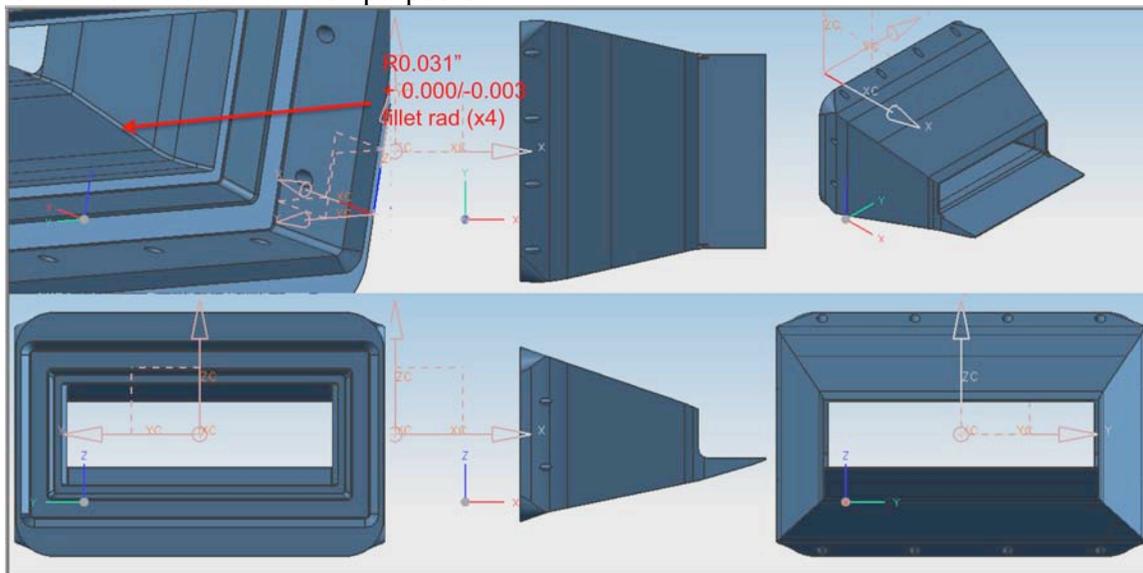


FIGURE 32 PARTID NA4K1—SIX VIEWS

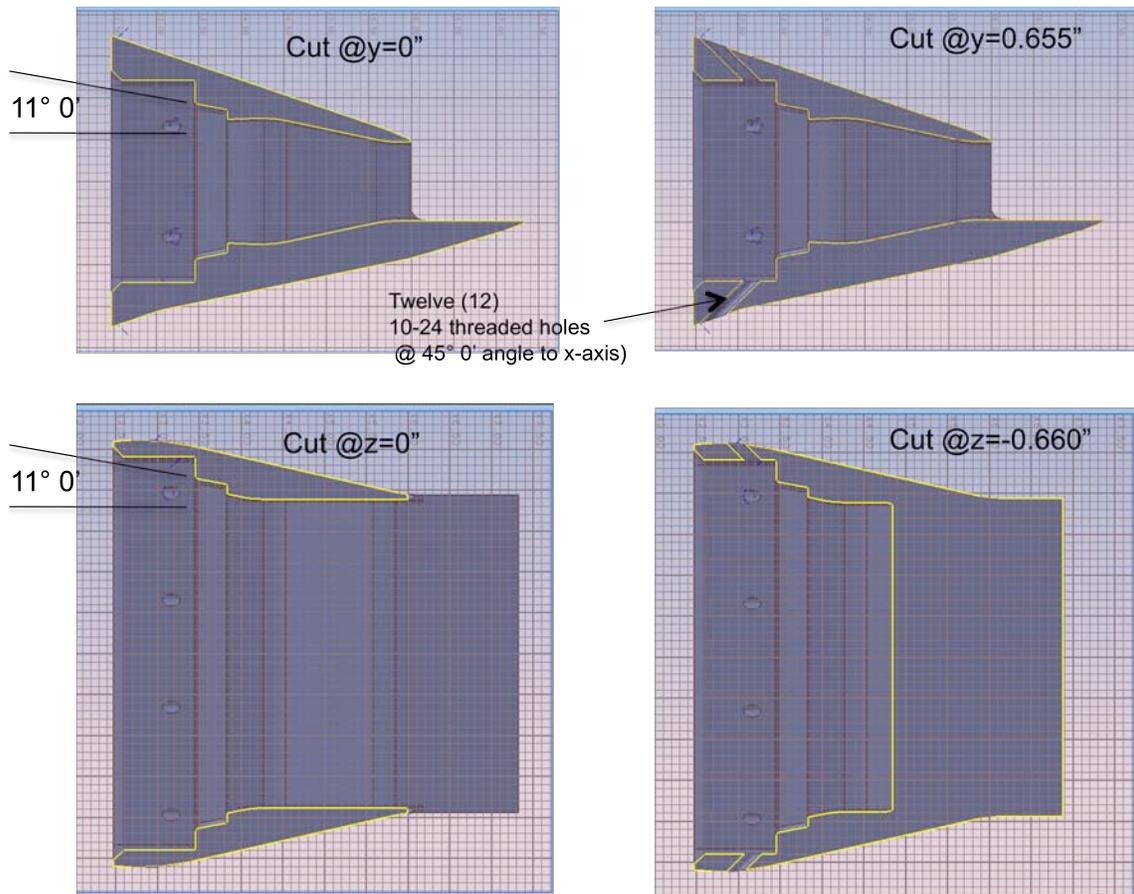


FIGURE 33 PARTID NA4K1—REFERENCE CROSS-SECTION

TABLE 16 INSPECTION POINTS FOR PARTID NA4K1

NA4K1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.211	1.000	0.000	1.402
					-1.459
1.100	0.000	±0.910	3.020	0.000	0.699
1.300	0.000	±0.871	1.000	±2.524	0.000
1.400	0.000	±0.744	3.020	±2.056	0.000
1.800	0.000	±0.756			
3.100	0.000	±0.505			
3.320	0.000	±0.474			
3.520	0.000	±0.472			
0.200	±2.402	0.000			
1.100	±2.118	0.000			
1.300	±2.454	0.000			
1.400	±1.943	0.000			
1.800	±1.887	0.000			
3.100	±1.887	0.000			
3.320	±1.887	0.000			
3.520	±1.887	0.000			



2.1.16 NA2C1, Chevron nozzle, 2:1, design 1

Views of the part are given in Figure 34. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 35.

Inspection points are given in Table 17.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38”

Length = 4.099”

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface shown in Reference cross-section is considered a mating surface for tolerance and surface finish purposes.

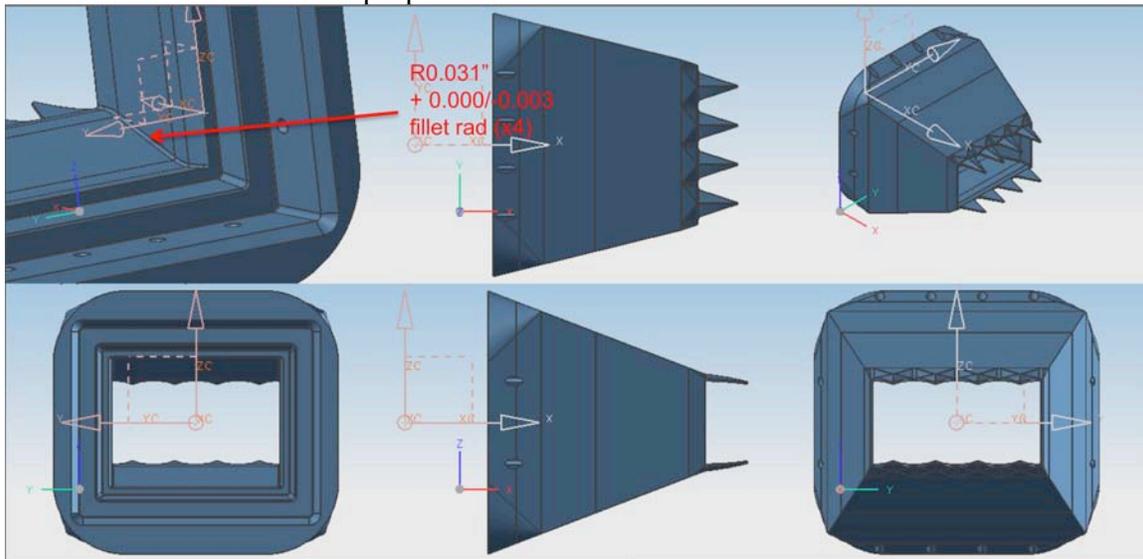


FIGURE 34 PARTID NA2C1—SIX VIEWS

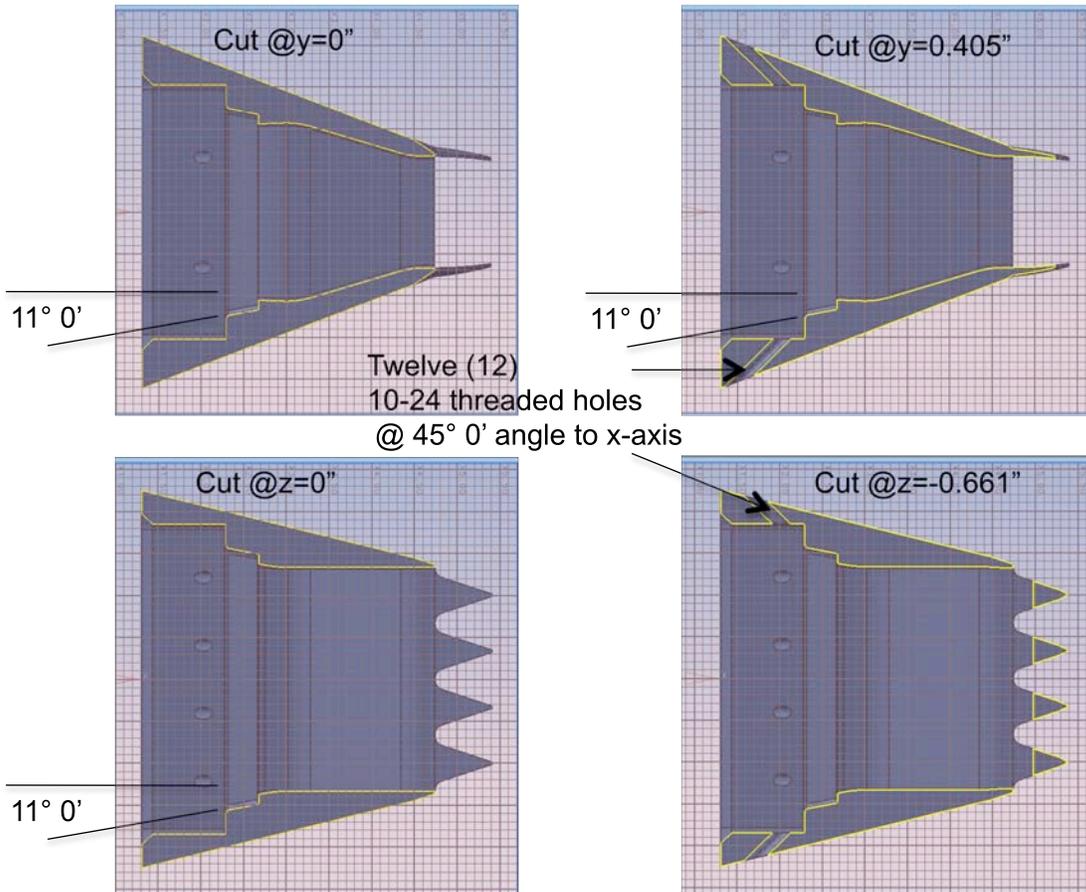


FIGURE 35 PARTID NA2C1—REFERENCE CROSS-SECTIONS

TABLE 17 INSPECTION POINTS FOR PARTID NA2C1

NA2C1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	±1.721
1.100	0.000	±1.221	2.931	0.000	±0.969
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.513	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
4.099	-1.001	±0.617			
4.099	-0.334	±0.617			
4.099	0.334	±0.617			
4.099	1.001	±0.617			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			



3.000	± 1.335	0.000
3.231	± 1.335	0.000
3.431	± 1.335	0.000

2.1.17 NA2C2, Chevron nozzle, 2:1, design 2

Views of the part are given in Figure 36. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 37.

Inspection points are given in Table 18.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38"

Length = 3.765"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface shown in Reference cross-section is considered a mating surface for tolerance and surface finish purposes.

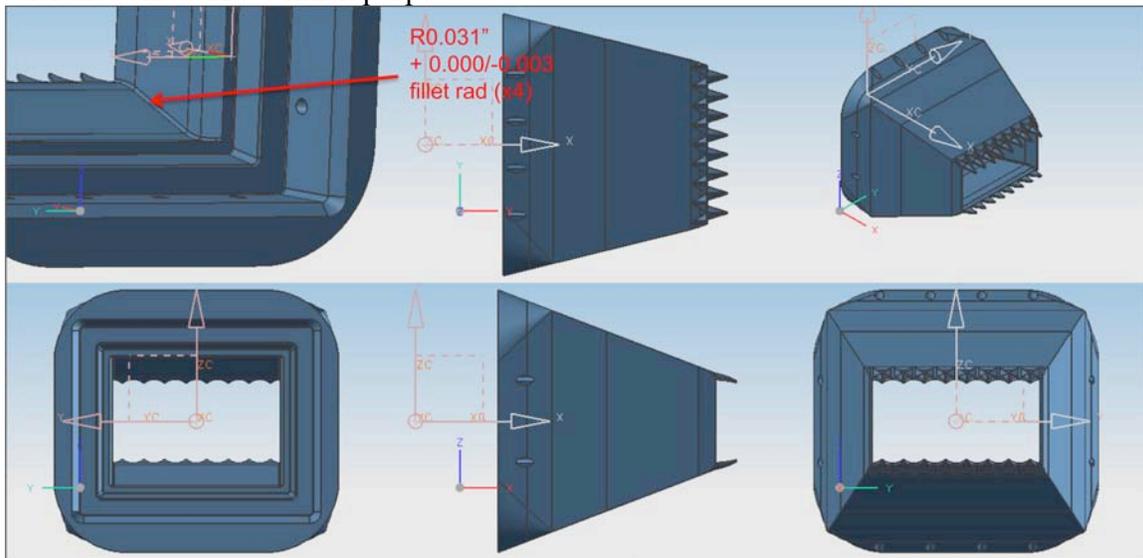


FIGURE 36 PARTID NA2C2—SIX VIEWS

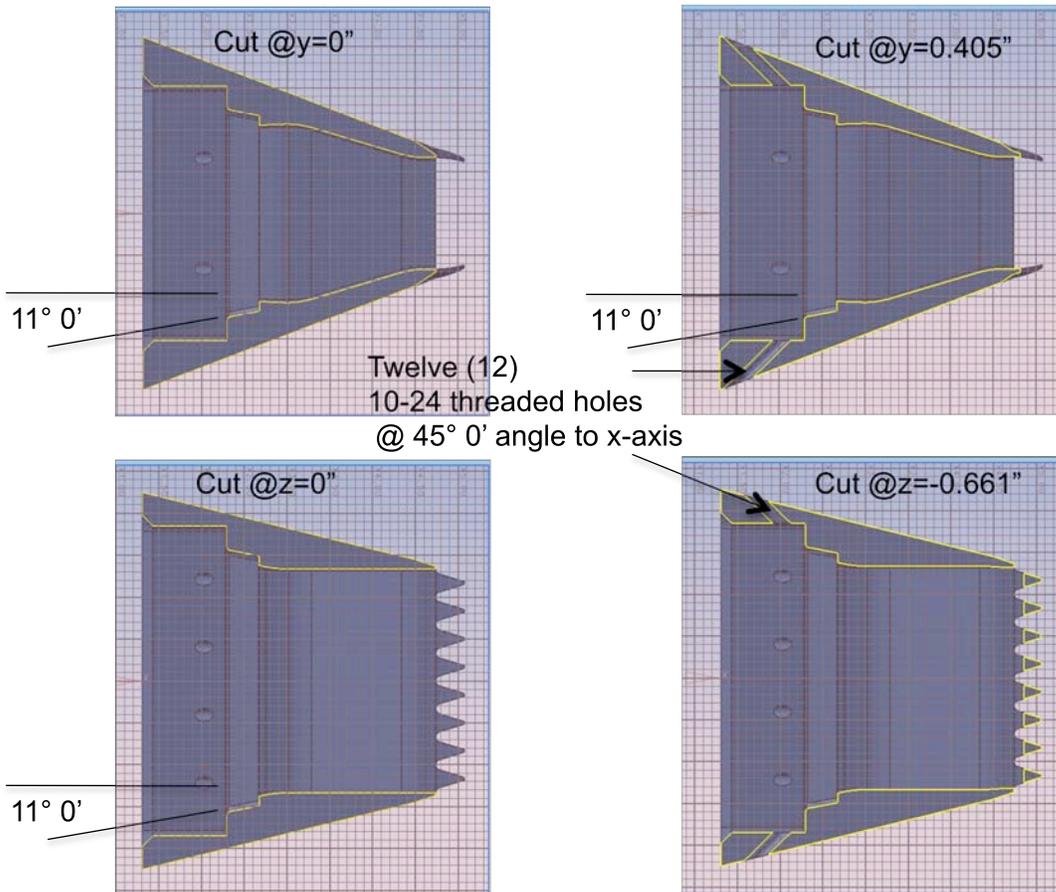


FIGURE 37 PARTID NA2C2—REFERENCE CROSS-SECTION

TABLE 18 INSPECTION POINTS FOR PARTID NA2C2

NA2C2					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	±1.721
1.100	0.000	±1.221	2.931	0.000	±0.969
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.513	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
3.765	-1.168	±0.617			
3.765	-0.834	±0.617			
3.765	-0.501	±0.617			
3.765	-0.167	±0.617			
3.765	0.167	±0.617			
3.765	0.501	±0.617			
3.765	0.834	±0.617			
3.765	1.168	±0.617			
0.200	±1.850	0.000			



1.100	±1.543	0.000
1.300	±1.504	0.000
1.400	±1.368	0.000
1.700	±1.335	0.000
3.000	±1.335	0.000
3.231	±1.335	0.000
3.431	±1.335	0.000

2.1.18 NA2C3, Chevron nozzle, 2:1, design 3

Views of the part are given in Figure 38. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 39.

Inspection points are given in Table 19.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38”

Length = 4.099”

Radius in internal corners of rectangular duct is specified as 0.031” in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface shown in Reference cross-section is considered a mating surface for tolerance and surface finish purposes.

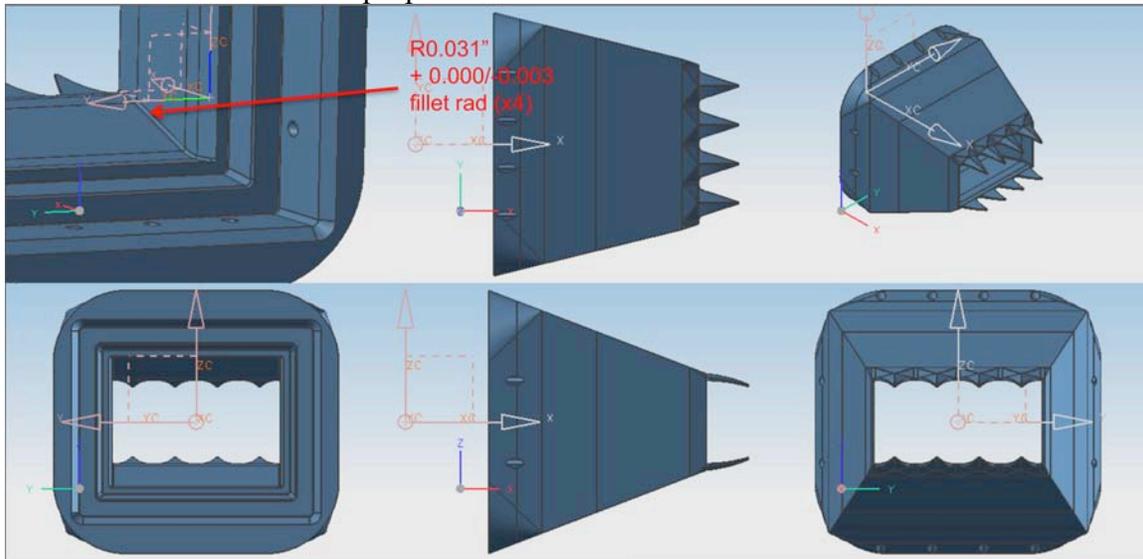


FIGURE 38 PARTID NA2C3—SIX VIEWS

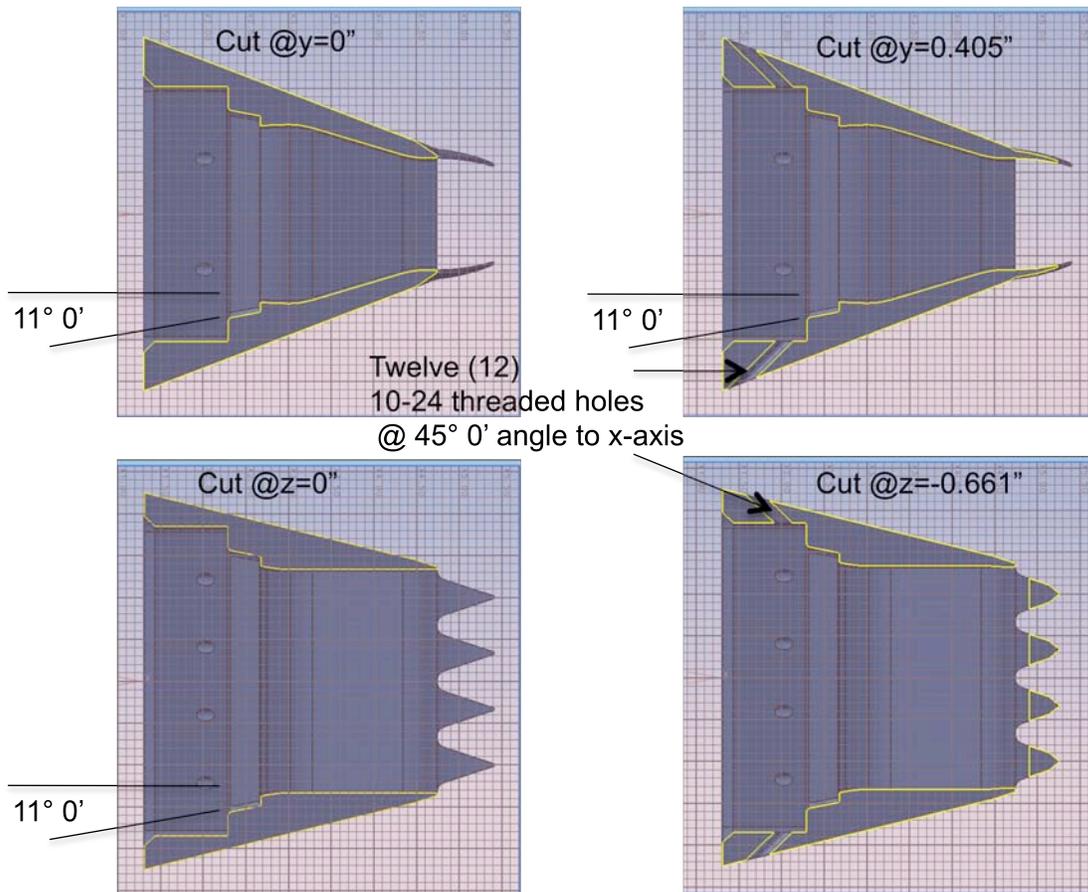


FIGURE 39 PARTID NA2C3—REFERENCE CROSS-SECTIONS

TABLE 19 INSPECTION POINTS FOR PARTID NA2C3

NA2C3					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	±1.721
1.100	0.000	±1.221	2.931	0.000	±0.969
1.300	0.000	±1.182	1.000	±1.998	0.000
1.400	0.000	±1.056	2.931	±1.513	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
4.099	-1.001	±0.567			
4.099	-0.334	±0.567			
4.099	0.334	±0.567			
4.099	1.001	±0.567			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			



3.000	± 1.335	0.000
3.231	± 1.335	0.000
3.431	± 1.335	0.000

2.1.19 NA2BC1, Bevel nozzle w/chevron, 2:1, design 1

Views of the part are given in Figure 40. Reference cross-sections pointing out location of threaded holes and critical angle are shown in Figure 41.

Inspection points are given in Table 20.

Nominal dimensions:

Max included diameter (centered about x-axis) = 5.38"

Length = 6.100"

Radius in internal corners of rectangular duct is specified as 0.031" in the solid model.

Threaded holes are 10-24 UNC threaded through.

Internal 11° angled surface shown in Reference cross-section is considered a mating surface for tolerance and surface finish purposes.

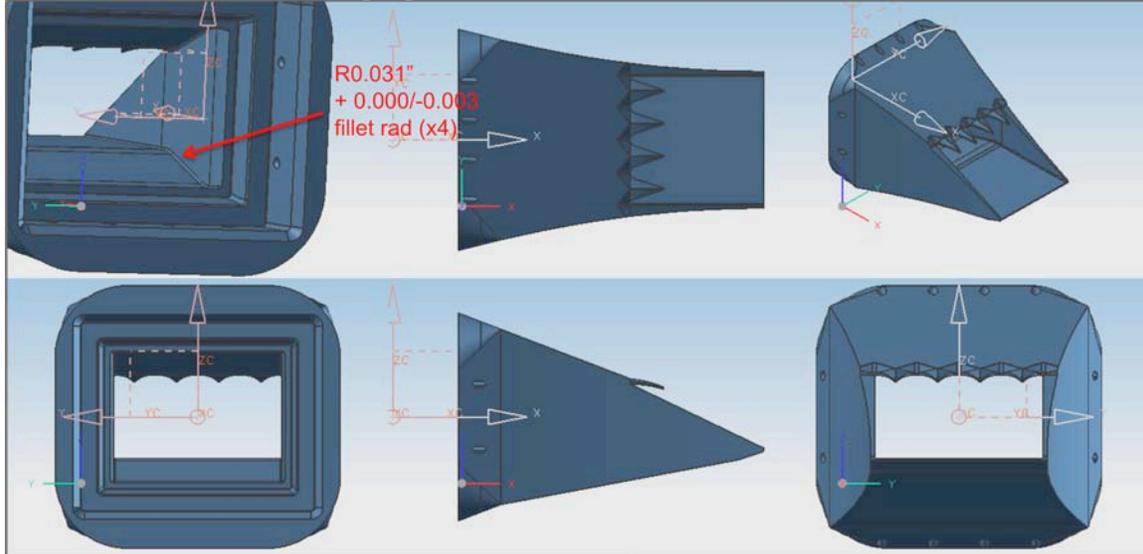


FIGURE 40 PARTID NA2BC1—SIX VIEWS

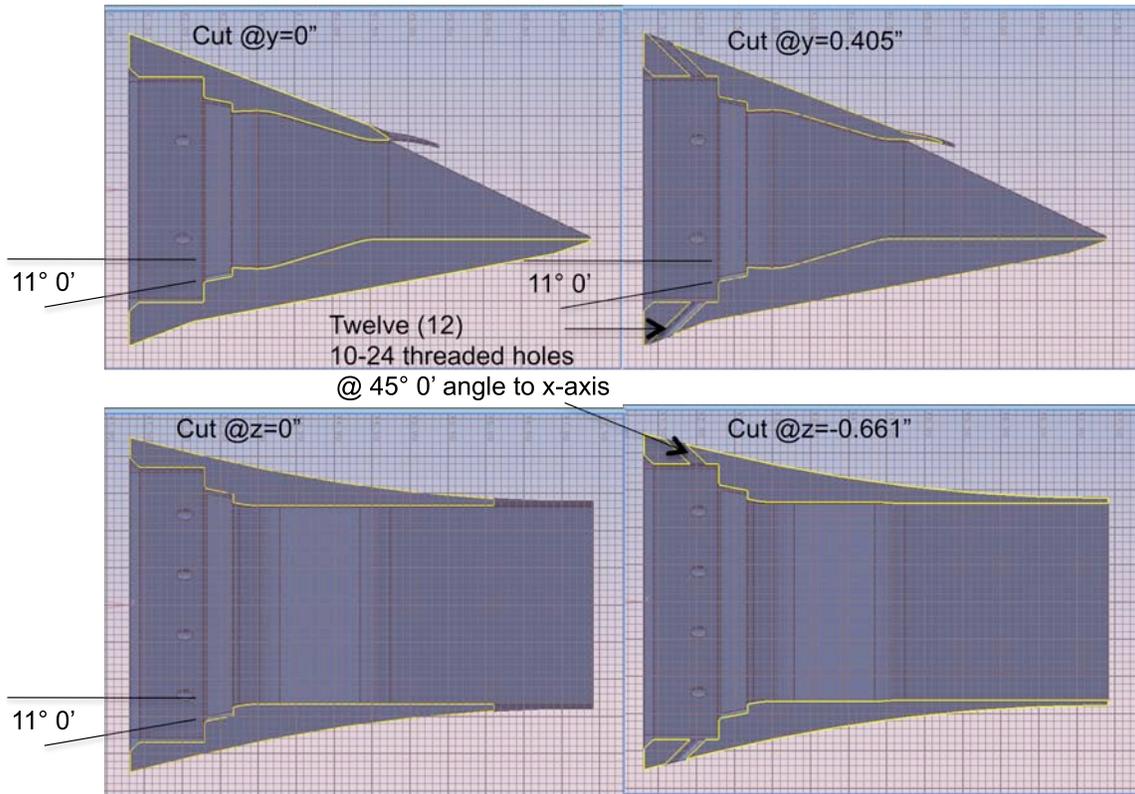


FIGURE 41 PARTID NA2BC1—REFERENCE CROSS-SECTION

TABLE 20 INSPECTION POINTS FOR PARTID NA2BC1

NA2BC1					
Internal surfaces			External surfaces		
x	y	z	x	y	z
0.200	0.000	±1.523	1.000	0.000	1.721 -1.752
1.100	0.000	±1.221	2.931	0.000	0.969 -1.381
1.300	0.000	±1.182	1.000	±1.999	0.000
1.400	0.000	±1.056	2.931	±1.622	0.000
1.700	0.000	±1.068			
3.000	0.000	±0.717			
3.231	0.000	±0.670			
3.431	0.000	±0.667			
4.099	-1.001	±0.567			
4.099	-0.334	±0.567			
4.099	0.334	±0.567			
4.099	1.001	±0.567			
0.200	±1.850	0.000			
1.100	±1.543	0.000			
1.300	±1.504	0.000			
1.400	±1.368	0.000			
1.700	±1.335	0.000			
3.000	±1.335	0.000			
3.231	±1.335	0.000			



3.431	± 1.335	0.000
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2.1.20 FASTEN, Fasteners for two assemblies

Two complete sets of fasteners for one model assembly shall be provided by the contractor, as enumerated in Table 21. Fasteners shall be bagged and identified.

TABLE 21 FASTENER LIST

Fastener description	Material	Quantity Delivered
Socket Cap Head Screws, 1/4"-28UNF x 0.625" length (or at minimum 0.5" length, maximum of 0.75" length)	A286	32
Oval Point Hex Socket Set Screw, 10-24UNC x 5/16" length	18-8 SS	24

2.2 Assemblies

Assemblies will consist of three pieces: each of the Nozzles connected to the Round to Rectangular Transition Ducts of the same aspect ratio as the Nozzle, and the SHJAR to Twin Jet Adapter. The three Transition Ducts are all to be interchangeable with the adapter. The nozzles are interchangeable with the transition duct that has the same aspect ratio. Figure 42 shows a typical assembly for reference. Cross-sections of the Round-to-Rectangular Duct and Baseline Rectangular Nozzles for the three different aspect ratios are shown in Figure 44 through Figure 45.

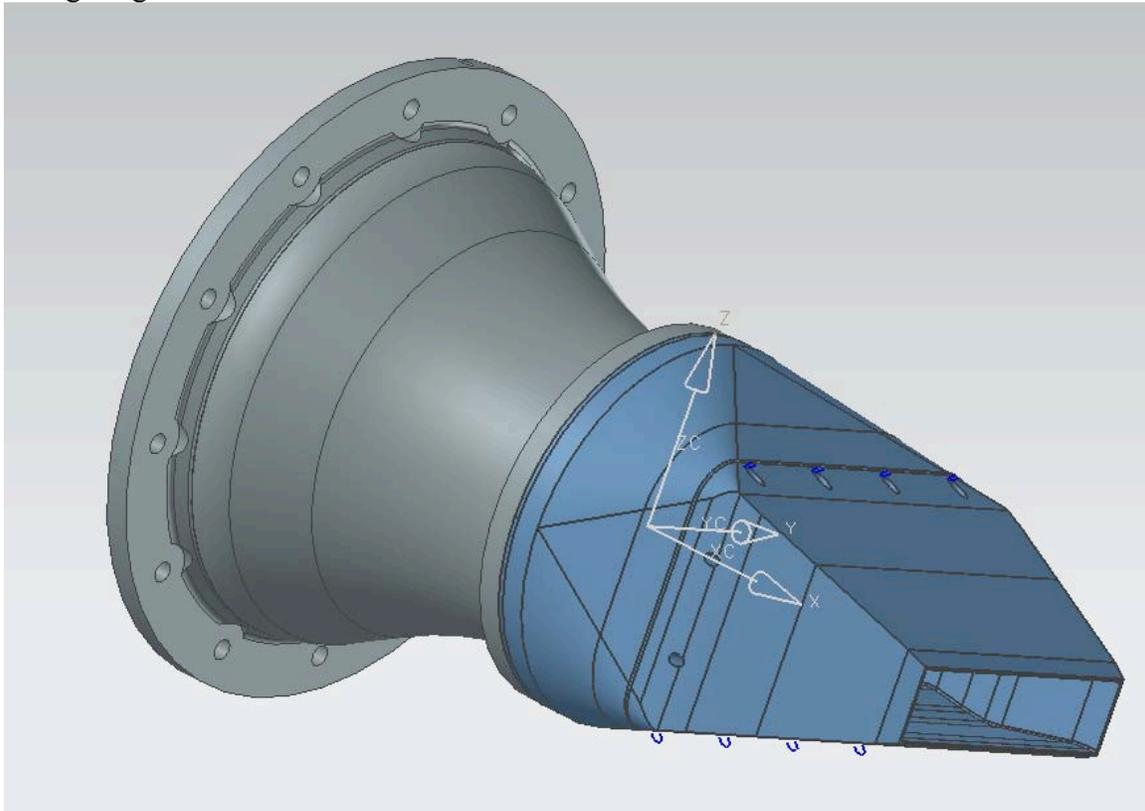


FIGURE 42 : TYPICAL ASSEMBLY INCLUDING DS2TJ, DR2A4, AND NA4Z.

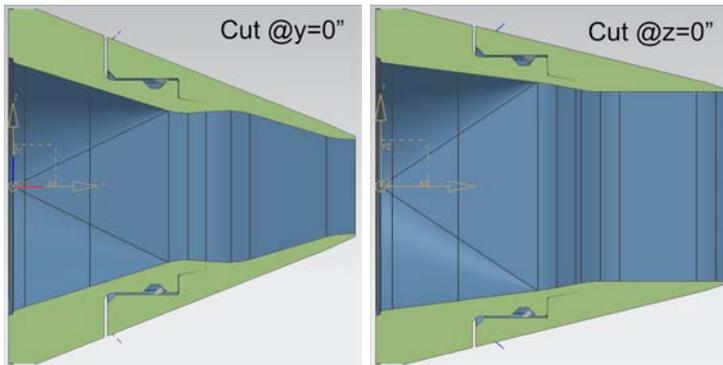


FIGURE 43 ASSEMBLY CROSS-SECTION INCLUDING DR2A2, NA2Z

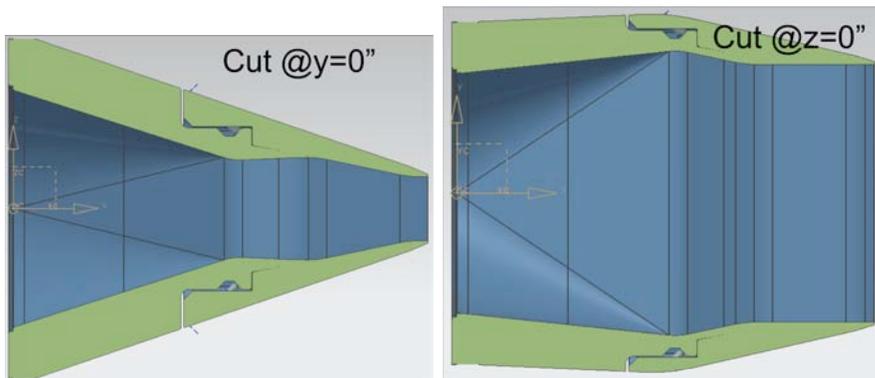


FIGURE 44 ASSEMBLY CROSS-SECTION INCLUDING DR2A4, NA4Z

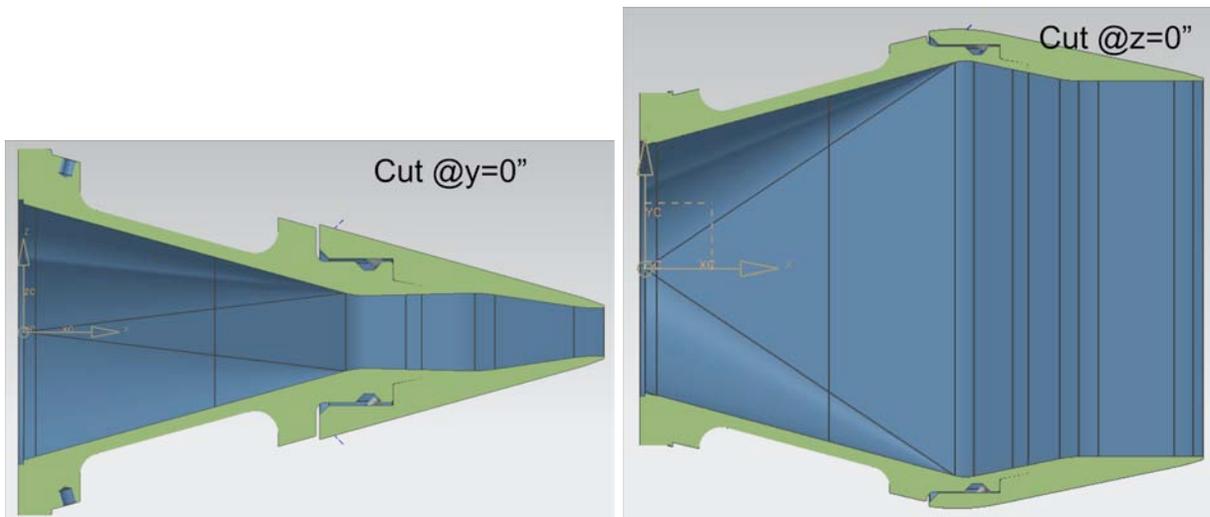


FIGURE 45 ASSEMBLY CROSS-SECTION INCLUDING DR2A8, NA8Z

3. MODEL FABRICATION REQUIREMENTS

3.1 Design – General

All parts will be machined from the solid model (CAD) files. No formal drawings will be released. Reference figures in this package, along with detailed specifications in Section 2.1, are used to supplement design details such as fasteners, tolerances, and surface finish. If any



contour changes outside the specified tolerances are required for manufacturing, the Requester shall approve any such contour changes before fabrication of the hardware.

3.2 Inspection

After machining, the Contractor shall inspect a given number of locations on the parts to validate that they meet tolerances relative to the solid model file. The locations of the inspections are listed in Table 2 – Table 20 along with the part descriptions. The coordinates in each table are the same as in the solid models with the origin shifted to the end of the part. In each table, the cells in bold designate values to be measured in inspection and reported.

If approved contour changes are made, the Contractor shall render views from the provided solid model and redline to indicate the as-built condition. These redlined views shall be included in the Quality Assurance & Inspection Package (QA&IP) document. The Contractor shall also provide a solid model of the as built Rectangular Nozzle Model. The files shall be in STEP and IGES formats and shall be on a compact disk. The as built contours shall be part of the Quality Assurance & Inspection Package.

3.3 Tolerances and Finish

Tolerances on internal flow surfaces are $\pm 0.003''$ except near joints and nozzle lips where the tolerances are $\pm 0.001''$. Tolerances on mating surfaces are held to within $\pm 0.001''$. Note that the angled surfaces of 10° and 11° called out in the Reference Cross-section figures are mating surfaces. Finish on mating surfaces between parts is $32 \mu\text{-in}$, on internal flow surfaces is $64 \mu\text{-in}$, and on all other surfaces is $125 \mu\text{-in}$.

3.4 Materials

All machined parts will be fabricated from 316 (not 316L) stainless steel per ASME-SA-479. Material may be substituted only after approval of Requestor. Fastener materials are specified in Section 0, specifically Table 21.

3.5 Material Certification

All machined materials supplied under this task shall be certified by the supplier that they meet the material specification called for in Section 2.1. Chemical and physical data shall be provided as part of the QA&IP. Heat treatment certifications shall be provided with documentation of temperature cycles and times at temperature provided as part of the QA&IP.

3.6 Identification

Designated PartID shall be stamped or etched (other methods may be accepted upon review by the Requester) on each model part in an area that is not in an internal flow or on a sealing surface. The raised edges shall be worked flush to the part.